AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 12, No. 10. WEEKLY. | NEW YORK, THURSDAY, MARCH 7, 1889. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

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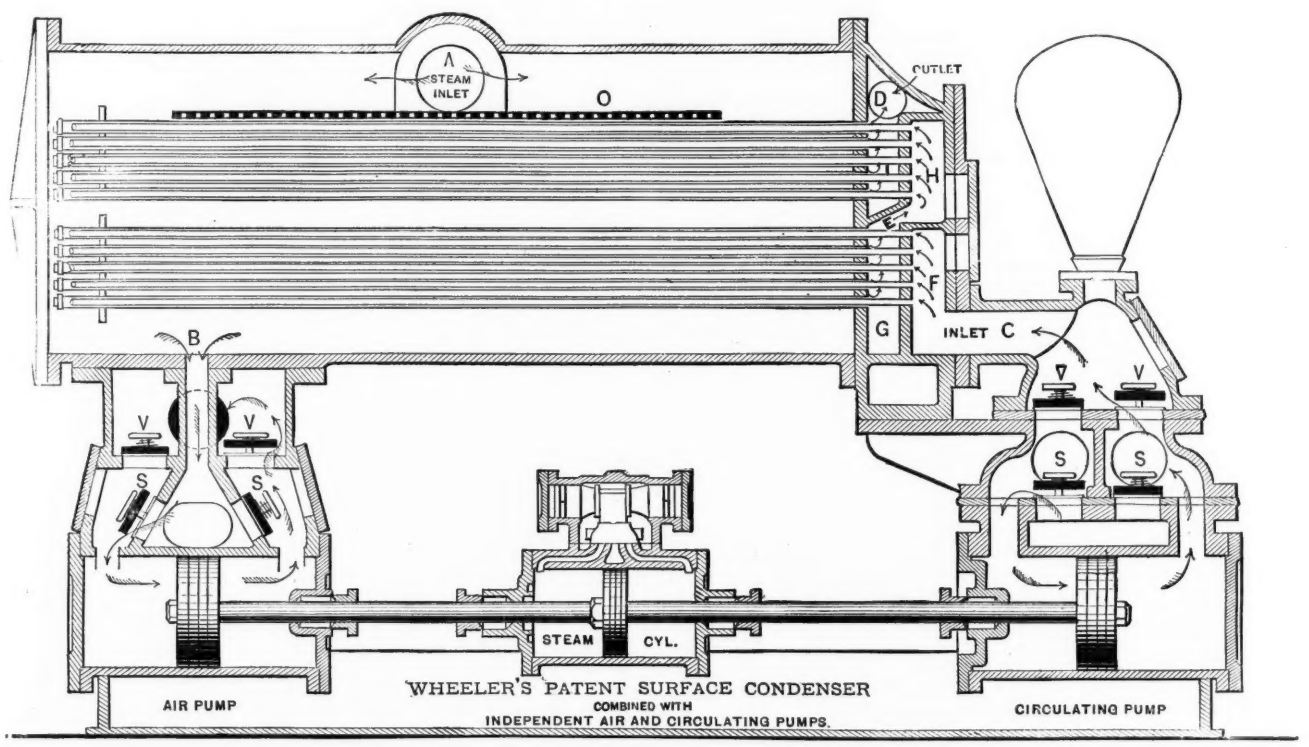
Wheeler's Improved Surface Condenser Combined with Independent Air and Circulating Pump.

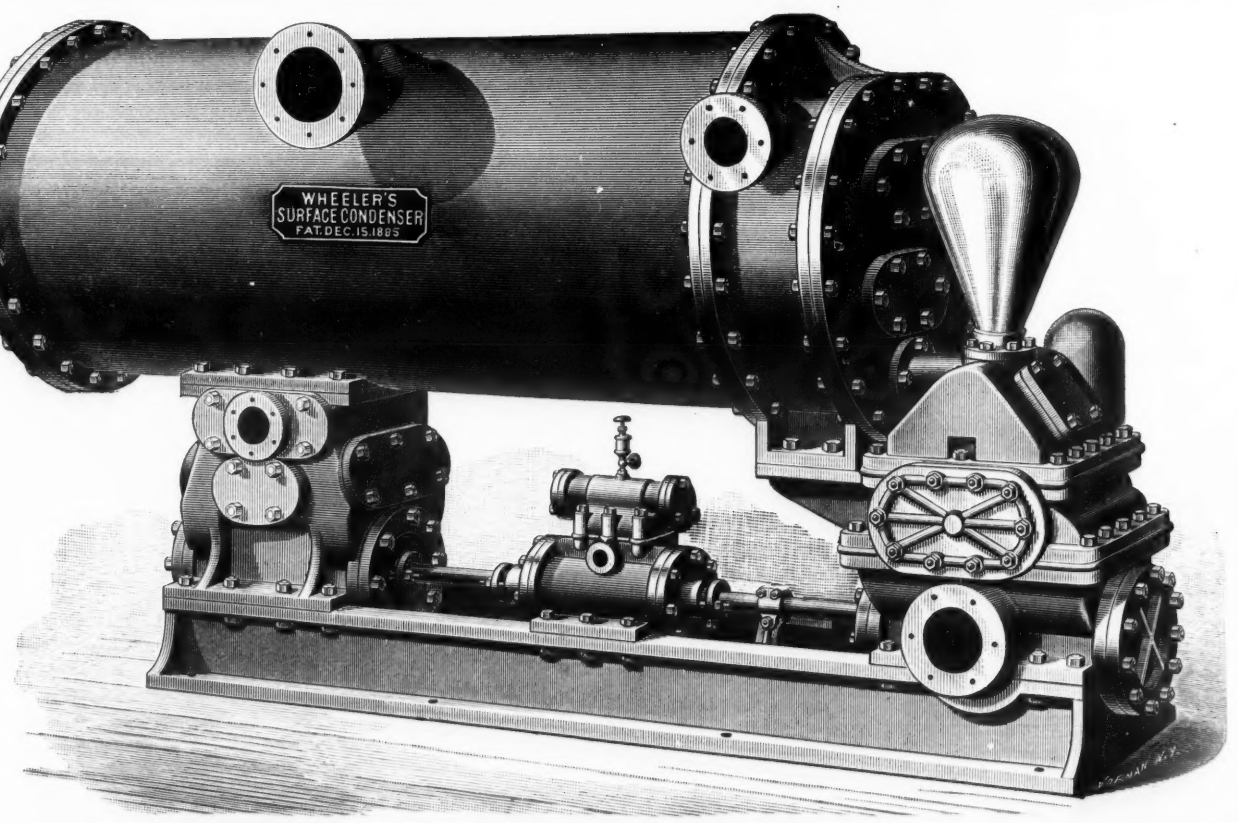
The accompanying cuts illustrate the combination of the Wheeler Surface Condenser with independent system of air and circulating pumps. The condenser is mounted on the latter, thus saving floor space, which is of considerable importance in engine rooms that are crowded with machinery, such as are found on many steam vessels and in numerous factories located in crowded towns and cities.

In this design, the condenser is firmly bolted down on the pumps, the latter serving as a foundation, thereby saving expense of piping between the pumps and the condenser. As shown by the sectional view, the water pump delivers the circulating water through the nozzle *C* directly into the lower section of tubes in the condenser. From thence the water flows by the passageway *E* into the chamber *H*, passing into the upper group of tubes, and finally discharging through the outlet nozzle *D*, as shown by the arrows.

The exhaust steam entering at the nozzle *A*, comes in contact with the scattering plate *O*, thereby distributing uniformly over the cooling surface of the tubes. The water of condensation gravitates to the bottom of the condenser, and flows directly to the air pump by the annular passage *B*, the air pump discharging the water through the outlet nozzle at the side of the cylinder. Both air and circulating pumps are operated by a direct acting steam cylinder in the usual way.



WHEELER'S PATENT SURFACE CONDENSER
COMBINED WITH
INDEPENDENT AIR AND CIRCULATING PUMPS.



SURFACE CONDENSER WITH INDEPENDENT AIR AND CIRCULATING PUMP.

In our issue of May 15, 1886, we showed quite fully the details of construction of this condenser. It may be well to state here, however, that the arrangement is one providing very thoroughly for the expansion and contraction of the tubes, and this without the use of tube-packings of wood, paper or similar materials. In fact, there are no ferrules, washers or packings of any kind employed.

The tubes are seamless drawn brass, carefully tinned inside and outside. The tubes are arranged in pairs, the smaller tube inside of the larger. The latter is thickened at one end, on which a substantial deep thread is chased. This end of the tube is screwed into a head of brass, and on the other end of the tube is screwed a cap, as shown. One end of the small tube is also drawn thick and a thread chased on it. This tube is also screwed into a head of brass. The tubes can be easily taken out and thoroughly cleaned, as their form and the manner of fastening permit of this being readily done.

The tightly screwed fastenings for tubes also permit the use of circulating water under pressure, which is often the case with stationary engines where the supply is from a head of considerable height—in other words there are no tube packings of any kind to be forced out or loosened by pressure of the circulating water.

The circulation of water is very thorough, and consequently the smallest amount of cooling water is required. This feature gives a marked saving in the power necessary for circulating pump.

In a test, witnessed by us, of a small experimental condenser of this type, the temperature of injection water being 56½ degrees, temperature of discharge 98 degrees, temperature of hot well 138 degrees, and vacuum 24½ in., 101.8 lbs. of steam was condensed per hour per square foot of condensing surface.

In another test the condenser was worked as a simple surface condenser without vacuum, and with injection 78½ degrees, discharge 139 degrees, hot well 201 degrees, 204 2 pounds of steam per hour per square foot of condensing surface was condensed.

The condensers are made with bodies of both circular and rectangular shape. The larger size are usually of the latter design. The patentee and proprietor of these improved condensers is Mr. Frederick M. Wheeler, 93 and 95 Liberty street, New York.

The watch-case makers of New York State want a law passed providing a good-sized penalty for stamping cases as of a finer quality than they really are. This is said to be the practice of unprincipled manufacturers, and it works to the disadvantage of those who do an honest business, and tends to encourage dishonesty. It is to be hoped the honest manufacturers will not only get such a law passed, but that they will see that it is enforced. Nothing is more demoralizing to any branch of manufacture than the certainty that unprincipled manufacturers are selling goods in the same line for what they are not, without much prospect of detection and without fear of adequate punishment if detected. We wish the watch-case makers all success. But what about the dealers who consent to handle watch-cases marked fourteen carats that are only in reality six or eight carats?

It is said that American carbons burn longer than those made in Europe, but do not burn so steadily.

Shop Notes.

By Jarno.

No. 14.

WORKING LOOSE—JAR—VIBRATION.

Machinists well know the troubles caused by jarring. The depth of a chip taken in a machine may be changed by jar. To have screws and nuts work or jar loose is the common experience of men in mechanical life. A descriptive list of the different lock nuts that have been invented would in itself give us some idea of the thought and time that have been given to avert the destructive power of jar. An interesting instance that serves as an example of this power came to my notice in the case of the stud, Fig. 1. The body *B* is the bearing of an intermediate gear *G*, that drives a cutter arbor. The threaded end *T* screws into the cutter head casting. The gear *G* turns in the direction that the stud would turn when being screwed home.

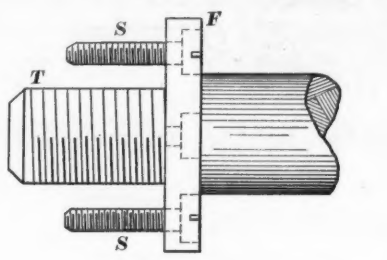


Fig. 2.

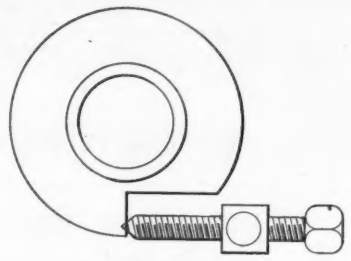


Fig. 3.

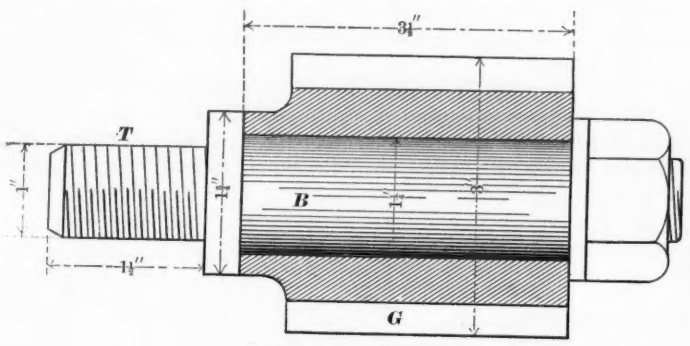


Fig. 1.

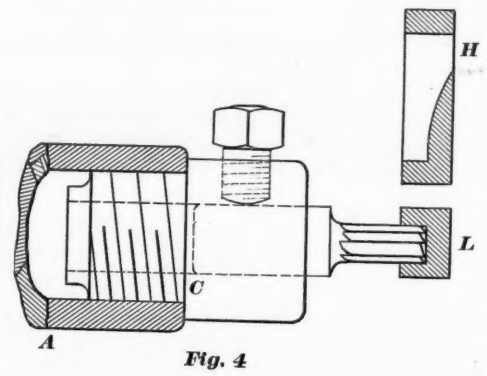


Fig. 4.

Shop Notes.

It will be seen that this stud is subjected to a part of the jar caused by the teeth of the cutter, striking and leaving the work or piece to be cut, the effect, as each tooth does its cutting, being like the blow of a hammer. Not long after starting up the machine the stud worked loose and unscrewed. It was repeatedly screwed home, but as often as it was screwed tight it became loose. This happened in two machines, which would lead us to suspect that there is a weakness in a stud of the proportions in Fig. 1, rather than an accidental destructive action in using the machine. This is the more apparent when we remember that the friction of the gear upon *B* tends to screw the stud home.

Two other studs like Fig. 2 were made, one for each machine. The flange or shoulder *F* was quite large, say about three inches in diameter. After screwing the studs up hard, four screw holes were made through the flange and threaded in the cutter head casting, in which were put the screws *S S*. It would now seem as if these studs would be amply rigid for the work expected of them; but not so. They soon worked loose, though not so soon as did the first ones. The feature of the second failure was that the screws *S S*, as well as the thread *T*, wore away. After tightening up the screws a few times there were on three of them no longer any threads that held, and new screws had to be put in. Of course, a stud could unscrew only a little way, because prevented by the screws, but when the thread *T* wore, and the screws were tightened, they took most of the strain, and then the stud, Fig. 2, was but little better than Fig. 1.

I think that the device for keeping a stud screwed tight, shown in Fig. 3, would be better than Fig. 2; that is, cut a notch in the shoulder, and arrange a set screw to press against one side of the notch. By setting up the screw, a stud can be kept tight. Such a device can hardly be recommended in designing machinery, but it would be quite as rigid and more economical than Fig. 2, because it can be tightened without stopping the machine.

When it can be done, it is well to have the part *T*, Fig. 1, about the same in diameter and as long as *B*, or perhaps longer, letting the thread run up about one-third of *T*, and having the remaining two-thirds not threaded, but fitted very tight. I think that a stud of these proportions would not need a special device to prevent its wearing and unscrewing.

A tower clock is expected to run five years or more, with no attention other than to oil and wind it up. To insure this it is not sufficient simply to hold any stud belonging to the clock, in the same way as Fig. 1. A stud has been loosened by the hourly movement of a light lever. The clock makers have the threaded part *T* long enough to go through a threaded hole in the frame casting, and take a nut on the other side. After screwing the shoulder up very hard against the frame, the nut is screwed tight, which brings an additional pressure upon the shoulder, and tends to keep the stud from unscrewing.

An acquaintance tells of a curious instance of the effect of jar, which may be understood by Fig. 4. In a shop where he worked there was a traverse drill, into whose spindle *A* was screwed a collet *C*. This machine was sometimes used to do milling, though it had no power feed. He wanted to make a level, and in a steel bar *L* he purposed to mill a slot to contain the bulb, while holding the mill in the collet *C*. He made one cut, and noticed that the slot was deeper at the end of the cut than at the beginning. Upon stopping the spindle he found that the collet was loose. He screwed it up hard, and made ready for another cut. He tied a weight to the feed crank, which would take the place of a power feed, and would stop when the crank was down. Having started the second cut he left the machine, as he says, to do something for the foreman. Upon returning he was surprised to find that the collet had again worked loose, and that the mill had cut its way entirely through the bar, and was sticking out on the other side at *H*. This was the more surprising from the fact that the teeth of the mill were cut straight, and that the mill turned in the direction that tended to screw the collet into the spindle.

Jar may be considered as a special case of vibrations, the term jar being applied to vibrations that are disagreeable or destructive. By the theory of vibrations or undulations, scientists have sought to explain the cause of the mysterious phenomena of heat and of light, but the nature of the cause of the vibrations is wholly unknown. While the vibrations called jar may unscrew the stud, and make it wear loose, another kind of vibrations might destroy it by melting or burning. I have seen a photograph of a shaft that is more than a foot in diameter, and about forty-eight feet in length. It would take several men to lift one end of this shaft, yet a blow of a hammer upon any part of it can be felt throughout its entire length. The scientist would say that the blow has set every particle of the shaft in vibration, and that the single visible movement of the hammer has been transformed into many smaller and invisible movements of the particles of the shaft.

Another kind of vibrations, much disliked by machinists, is called chattering. Its noise is disagreeable, and generally its effect is rough work. A curious kind of chattering is sometimes caused by grinding a springy piece of steel, when held in the hands. The sensation caused by this chattering is precisely as if the steel were hot, though it may be quite cool. This would indicate that there is some connection between vibrations and the sensation of heat.

Another acquaintance tells of an instance that shows the power of vibrations. He worked in a shop that was driven by water-power. The vibration of the water running over the dam caused a jar that broke the window panes. To stop this, obstructions were placed at different places along the dam, so that all the water running over would not vibrate in the same time.

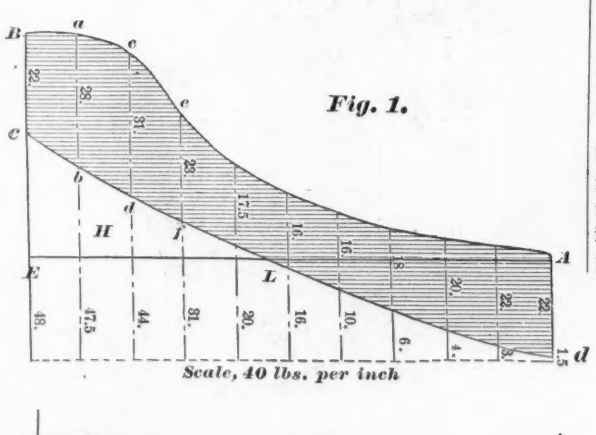


Fig. 1.

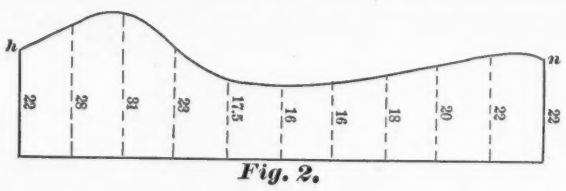


Fig. 2.

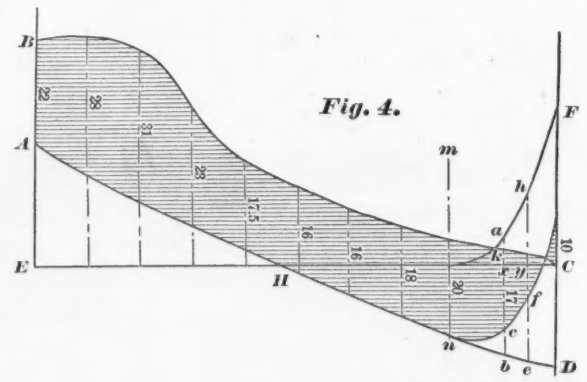


Fig. 4.

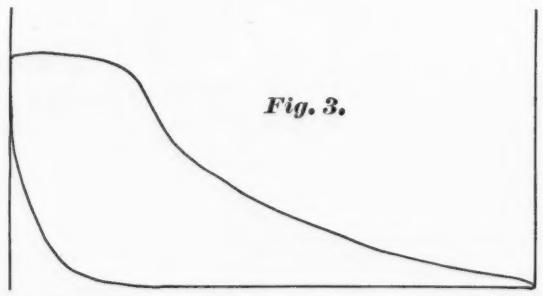


Fig. 3.

Force in the Steam Engine.

Force in the Steam Engine and its Relation to Smooth Running.

By Professor Joseph Torrey.

NINTH PAPER.

The effect of inertia in equalizing pressures on the crank-pin, throughout the piston stroke, is a very subtle and important one, and needs to be thoroughly understood. We have seen in the first paper of this series, how the diagram of steam pressures can be constructed from the indicator diagram, and lately we have seen how to construct the theoretical inertia curve or inertia diagram for any engine. It now remains to show that when these two diagrams are combined we can see at a glance the extent to which inertia has equalized pressures on the crank-pin throughout the stroke.

To simplify the matter, let us take the case of an engine running without any compression at all. In this case the regular diagram from one end of the cylinder will be the true diagram of steam pressures for one stroke. In Fig. 1 is shown such a diagram in which the pressures on the crank-pin, so far as the steam goes, are certainly very irregular. At the first of the stroke, with the suddenness of a blow the pressure rises to 48 lbs. in the original diagram, while at the end it is about 2 lbs. Now suppose, taking the lower line of the diagram as our neutral line, we trace the inertia curve of this particular engine, knowing the number of revolutions per second, weight of reciprocating parts, length of stroke, etc., and find it to have the contour *c d*. Now let us see the combined effect of steam and inertia. Remember that the inertia during the first of the stroke is resistence to motion (or additional motion, as the case may be), and it consequently neutralizes some of the actual steam force applied to the piston, so that it never reaches the crank-pin. Hence the area *H* must be subtracted from the area of the steam diagram, leaving the area *C B A L* as effective force at the crank-pin. But to this must be added the area of *d A L*, which means resistance to being brought to rest, that is, *impelling force*, and by adding this area to *C B A L* we have the area *c B A d* as the diagram of real pressures at the crank-pin. If we wish to know the average pressure exerted on the pin for one stroke, we first divide the base line into ten parts, then draw a perpendicular through each point of division; on these perpendiculars measure the lines *a b*, *c d*, *e f*, *g h*, etc., and then, knowing the number of pounds per sq. in. represented by one inch of length, or, in other words, the scale of the diagram, we can at once write down the pressure represented by each perpendicular. In this case the diagram is on a scale of 40 lbs. per sq. in., and *a b* represents a pressure on the pin of 28 lbs. per sq. in., *c d* represents a pressure on the pin of 15 lbs. per sq. in. We can get a little better view of the actual distribution of this force, if, after finding the real pressure on the crank-pin for ten points in the stroke, we draw a line exactly the length of the atmospheric line, divide it into ten equal parts, draw perpendiculars as before, and lay off on these perpendiculars the crank-pin forces found, in

their order. Thus, in Fig. 2 *h n* represents the distribution of force on the crank-pin for the forward stroke.

In the engine just considered there was supposed to be no compression. Now let us see how compression will affect the *diagram of actual effort on the crank-pin*, as we will call it.

Fig. 3 represents the same diagram previously used, only with some compression. Obviously the first effect of compression will be to give a different looking diagram of real steam effort. It will resemble Fig. 4 (*B E A F K*). Now let us put on our inertia diagram, just as before, and then proceed to see how the different forces result. The first part of the diagram, *i. e.*, that to the left of the line *m n*, will be just as before. As we near the end of the stroke, however, we are confronted by compression. Now this compression is evidently working against inertia, because the tendency of compression is to stop the reciprocating parts, while the inertia, or momentum, propels them on. Since, then, these forces are working against each other, it follows that the greater force will finally neutralize the less, and the difference between them will be the actual force which will appear at the pin. Suppose the diagram to be finished as though there were no compression at all. We should then have the area *A B C D* as the diagram of effort on the crank-pin, but after compression begins it is clear that it is destroying impelling force as fast as it rises. For instance, at *x* compression amounts to, perhaps, 5 lbs. per sq. in., and, evidently, this just neutralizes 5 lbs. per sq. in. of the impelling force, therefore there must be subtracted from the length *a b* a length which will represent 5 lbs. per sq. in., hence we cut off from *b a* the distance *b c*, which represents, according to the scale, 5 lbs. per sq. in. In the same way at *y* we have a compression of about 10 lbs.; and here too we must cut off from *e* the distance *e f*, which equals, on our scale, 10 lbs.; proceeding in this way to the end of the stroke, we finally obtain the area *A B C D* as the diagram of effort on the crank-pin.

The most hasty glance shows a marked and important difference between this and the former diagram, where there was no compression. The first parts of the two diagrams are identical, but in the last case the pressure on the crank-pin rapidly diminishes as the crank approaches the center, and near the end of the stroke the pressures are for an instant perfectly balanced, there being no pressure at all on the pin. At the end of the stroke it is seen that the pressure has been transferred to the other side of the journals, and what pressure there is on the pin (about 10 lbs. per sq. in.) is in the direction of the next stroke. We saw, in the first paper, that this apparently happens in every case where compression is employed; but a glance at the last two figures (Fig. 3 and Fig. 4) will show that inertia modifies the action considerably. It would be possible to adjust the inertia so that there would be no pressure on the pin or centers at all; and probably, everthing considered, this would be the best arrangement that could be made between steam and inertia; however, we will discuss this point later. One thing needs to be pointed out here, namely, that the inertia line, as we lay it down, is a theoretical line; that is, that it supposes perfect rigidity in all parts of the engine which are exposed to shock. This, of course, is only approximately true, and, in the case of a large proportion of engines designed to-day, would be a pretty rough approximation. If we should draw in the diagram from the other end of the cylinder in Fig. 4, and construct the diagram of real pressure on the crank-pin, we should have a very similar figure to that shown in Fig. 4. The main difference would be that, since the inertia of the front end is less than at the back end, a little less of the steam pressure would be neutralized at the beginning of the stroke, and at the end of the stroke the inertia and compression would, in this case, come near balancing, since inertia would be greater than it was at the front end.

In Figs. 1 and 4, I have laid off, at 10 points in the stroke, the actual pressures on the crank-pin as modified by inertia. In Fig. 1 I have written at the bottom the pressures that would come on the pin if it were not for inertia.

The average of these pressures, unmodified by inertia, is 21 lbs., and it will be seen how widely the pressure ranges away from the average at different points in the stroke. On the other hand, the average of the actual pressures, in Fig. 1, is, of course, the same, 21 lbs., but the variations from the average throughout the stroke are much smaller than in the former case.

Thus does inertia change the state of things at the crank-pin. The practical application of these principles to engine design was, as everyone knows, first made by Mr. Porter, in the Porter-Allen Engine, which to-day retains this feature to a considerable extent. The necessary inertia in the reciprocating parts was obtained by making the crosshead, and other parts, rather heavier than had been done up to that time. Sometimes the necessary inertia can be obtained by an increase of speed. The writer has in mind two striking examples of this kind, one of a large medium speed engine, running at 100 R. P. M., which was only reduced to quiet running by raising the speed to 115 R. P. M. The other was the case of a marine engine, which showed the same peculiarity in a marked degree, running at 150 revolutions smoothly, while at its regular speed, 120 revolutions, there was a very decided "pound" at the upper end. These cases are given because very recently observed.

Professor Thurston points out very neatly, in his little book on "Stationary Steam Engines for Electric Lighting Plants," that there would in every case come a time, as rotative speed increased, when the weight of the parts, as proportioned for strength alone, would be sufficient to develop the required inertia, and he suggests that this may, at some future time, prove to be the normal and natural speed of the steam engine. One thing is certain, every designer knows the economic value of high rotative speed, considered with reference to steam consumption, and the probability is that every one runs his engines as fast as he dares to. There is no reason to anticipate any decrease in standard rotative speeds. The tendency is in the other direction, and it would not be at all surprising if the next ten years should see as much of a jump in speed as the past twenty years have witnessed. It is also worthy of remark that the rapidly rising boiler pressures of to-day make the facts brought out thus far in our investigation of effort on the crank-pin, of ever increasing interest and importance. The examples I had intended to present from actual practice, I will give in the next paper.

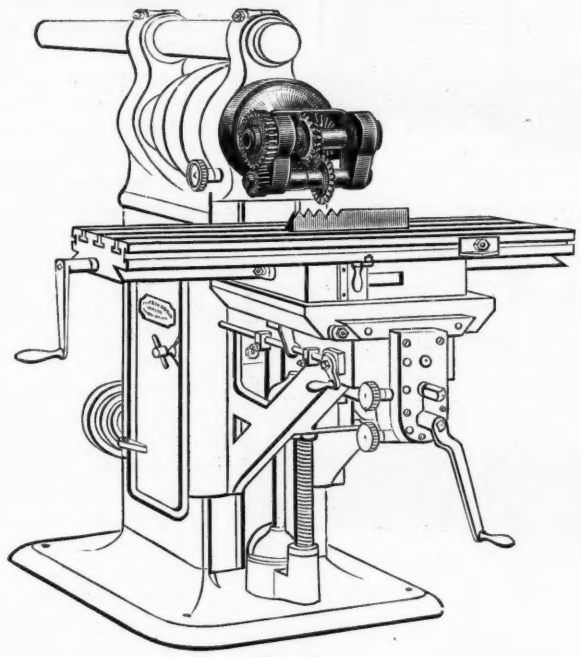


Fig. 1.

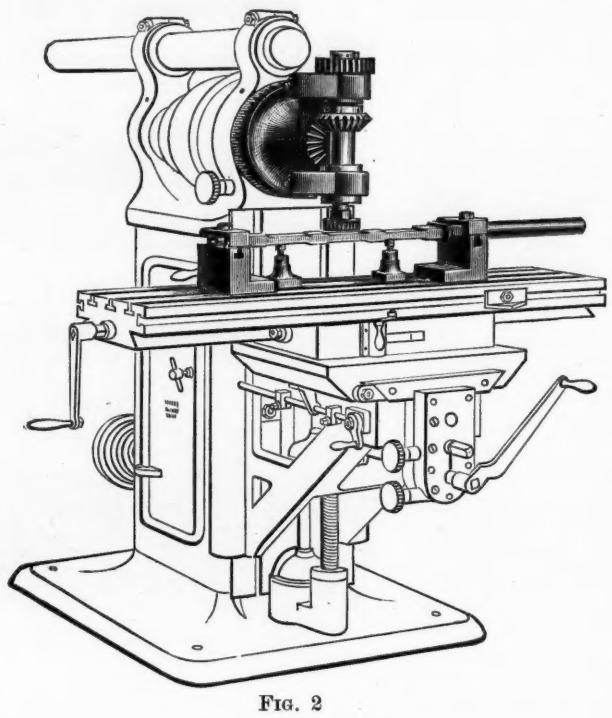
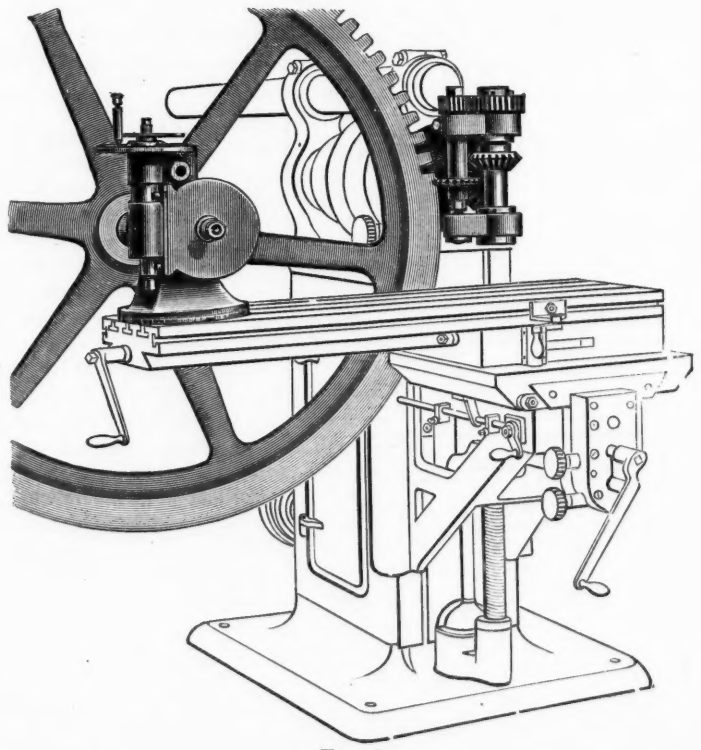


Fig. 2



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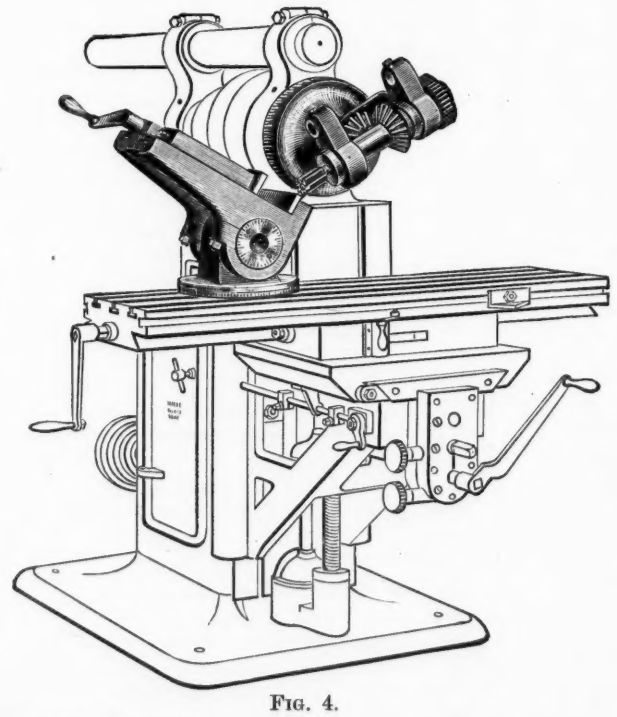


Fig. 4.

Attachments to Universal Milling Machines.

Attachments to Universal Milling Machines.

Accompanying this are four cuts, showing some of the special features and adaptations of the universal milling machine built by Pedrick & Ayer, Philadelphia, Pa.

The machine itself was illustrated and fully described in our issue of Jan. 17 last, the object of the present illustration being to show some of the special applications of an attachment which was mentioned at that time, but not shown in the cut.

Surrounding the main spindle bearing and upon the face of the boxing is a scraped surface, to which may be fastened an attachment which is provided with two spindles which are driven by means of bevel gears, one of which is upon the end of a stem which fits the taper hole in the main spindle of the machine. The head which carries three supplementary spindles can be swung in a vertical plane and clamped, so as to bring the spindles at any desired angle to the platen. Then the fact that the platen has an automatic feed in any direction; vertical, in line with the spindle, at right angles, or in fact any angle with the spindle, makes this attachment useful for many purposes and capable of doing many jobs which cannot be done without it.

Fig. 1 shows the attachment with the side spindle in use, as for cutting a rack or any piece of work requiring a series of cuts across its length. For such work the spindle is set parallel to the platen, which is fed automatically at a right angle to its length, and the feed automatically thrown out at any desired point. The spacing is done by a graduated dial at the end of the platen, which reads to thousandths of an inch. The machine can

be used in this way for cutting up stock, and a piece of any desired length can be cut through in the middle.

Fig. 2 shows the attachment with the side spindle removed and the central one holding a side mill, operating upon a Corliss valve stem. By means of the V blocks the work can be done true with the previously turned parts, and much more quickly than it can be done by planing. The various automatic feeds make it possible to work around the various shoulders very expeditiously and with the least possible amount of labor. This, of course, is merely typical of a large class of work which can be done in this manner.

Fig. 3 shows the attachment in use for cutting a large gear wheel. For this purpose the universal index head is set at right angles to the platen, and the gear mounted upon an arbor which is fitted to the taper hole in the index head spindle. A T slot is provided in each edge of the platen, and one of these is made use of in such a case to clamp the rim of the gear firmly, while the cut is going through. It will probably be observed that the engraver who made this cut was not fully up on gear cutting, or he would have placed the cutter in line with the center of the gear. This he could have done either by raising the platen or by inclining the cutter spindle towards the gear.

In Fig. 4 the universal vise chuck is shown in connection with the other attachment, using a stem cutter. The base of this vise is graduated, so that angles may be set off in a horizontal plane, and at the same time it can be inclined, as shown, to any desired angle. This, together with the facility with which the spindle attachment can be placed in any desired position, making it possible to do many difficult or complicated jobs at one setting in the vise. Drilling may also be done at any angle with the platen or in line with it. Bevel gears can be cut, and, in fact, an almost infinite variety of work done with the greatest facility. A bar is furnished, having a traveling head by which cylinders may be bored, the platen being swung round into line with the spindle for this purpose, and the outer support for the bar being fixed to the outer end of platen. In this way air-brake or pump cylinders can be bored out. Various other attachments are furnished for doing a large variety of work, most of which have been illustrated from time to time in our columns, and full information regarding which may be obtained by addressing the makers as above.

Modern Locomotive Construction.

By J. G. A. Meyer.

EIGHTY-SIXTH PAPER.

Fig. 480 represents another form of crank-pin used for solid-ended side rods; it differs from that shown in Fig. 479 (last paper) in the fact that it has no loose collar for holding the side rod in position after the latter has been slipped onto the journal; instead of a loose collar a groove *a* is turned into the journal near the end. The design of side rod used for this pin is shown in Figs. 481 and 482. A solid brass bushing is forced into the end of the side rod; a brass plate *B* made in two pieces is made to fit into the groove *a* in the crank-pin journal, a brass cap *C* covers the end of the pin; four bolts, *D D*, extend through the whole width of this side rod end and hold the cap *C* and the plate *B* firmly in position, and also prevent the brass bushing from turning around should it become loose through constant service. The bolt-heads are countersunk into the flange of the bushing, as shown in Fig. 483.

Fig. 483 represents in detail the brass bushing *A*; Fig. 484 represents the brass plate *B*; and Fig. 485 represents the brass cap *C*; these require no further explanation.

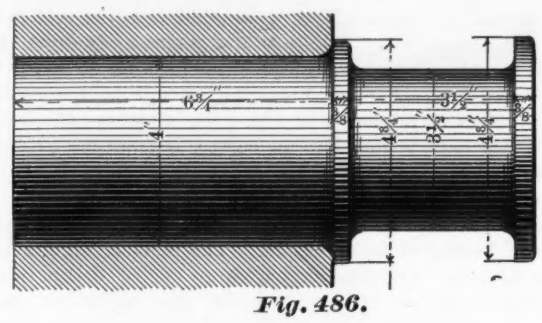


Fig. 486.

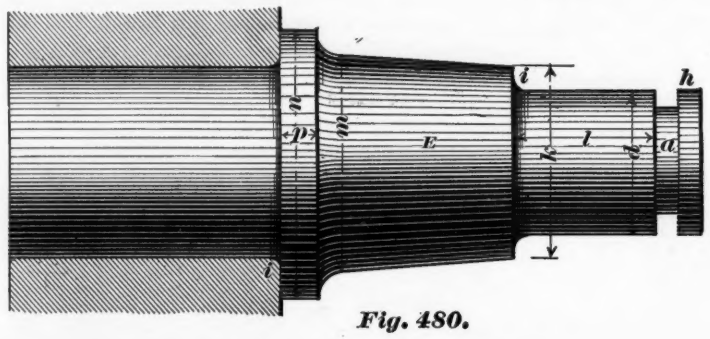


Fig. 480.

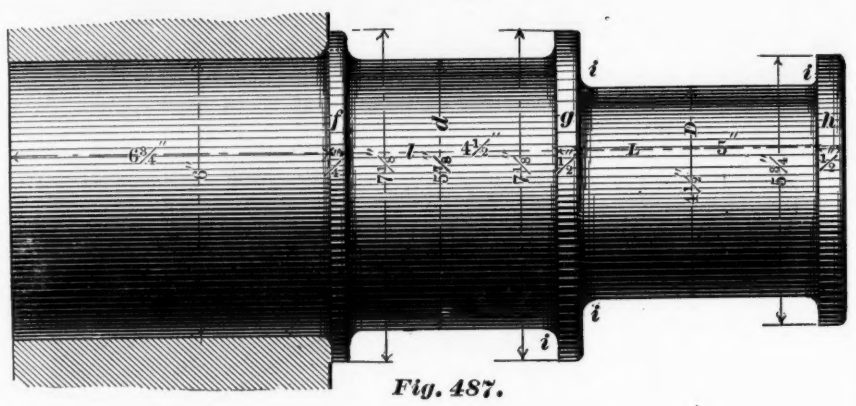


Fig. 487.

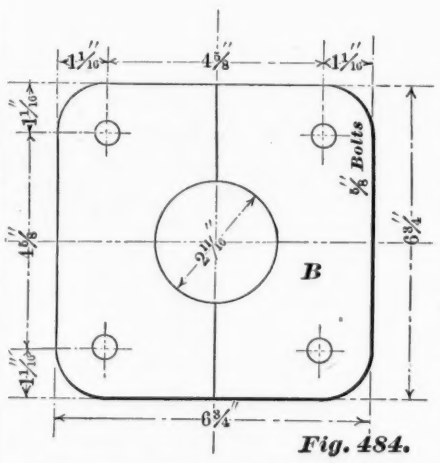


Fig. 484.

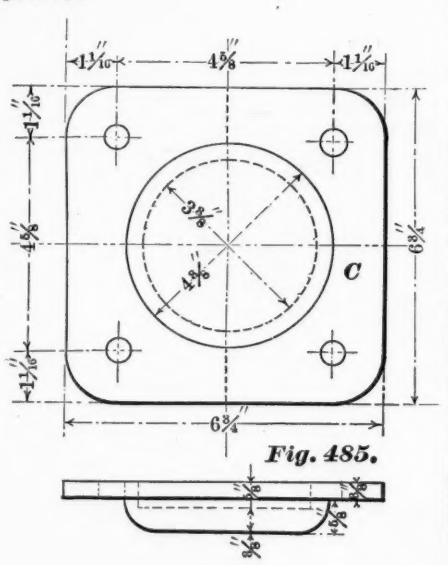


Fig. 485.

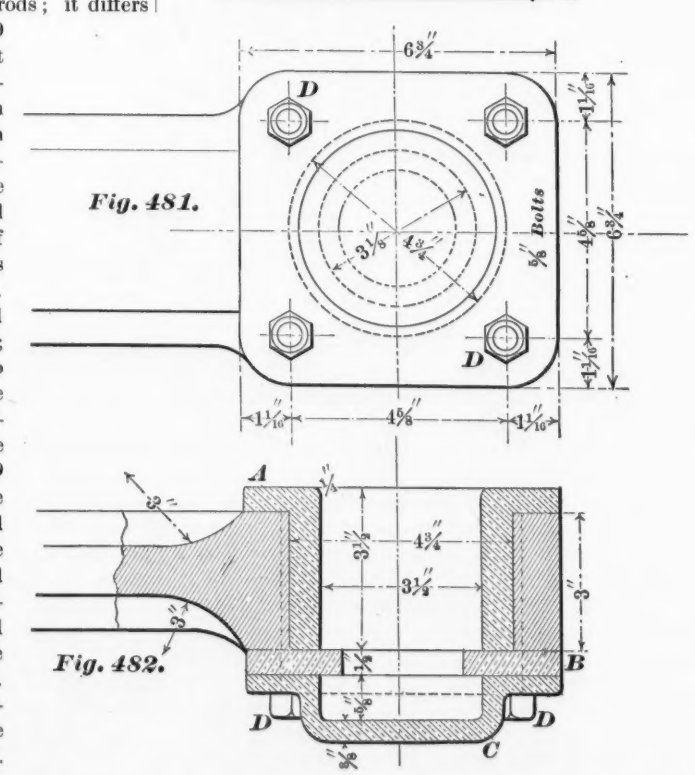


Fig. 481.

Fig. 482.

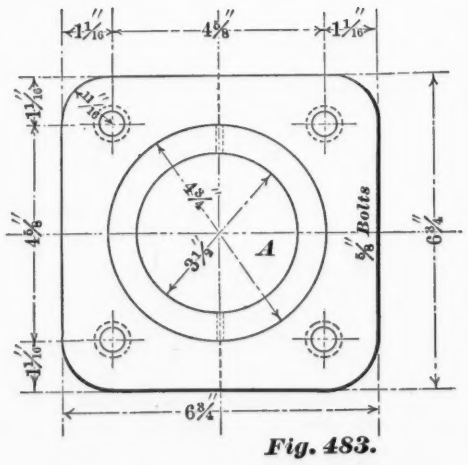
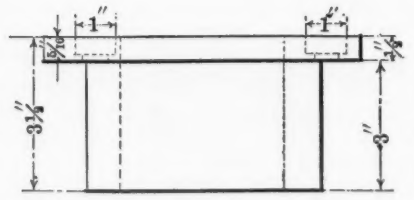


Fig. 483.



In ten-wheeled, mogul and consolidation engines, the arrangement of the side and main rods generally differs from the arrangement of those rods in passenger engines. In the latter class of engines we have seen that the main rod takes hold of the inner journal of the main crank-pin; in the former classes of engines the main rod generally takes hold of the outer journal of the main crank-pin, thus bringing the side rods next to the wheels.

Fig. 487 represents a main rod-pin for a consolidation engine having cylinders 20 inches diameter; and Fig. 486 represents the *a* side rod-pins for the same engine. The main crank-pins for consolidation, mogul and ten-wheeled engines are generally similar in form; hence the rules by which the dimensions of the crank-pin journals for one of these classes of engines can be determined, can also be used for finding the dimensions of similar crank-pin journals for the other two classes of engines.

Many master mechanics prefer iron crank-pins, while others, probably a majority of them, prefer steel pins. The following rules are for steel pins. In establishing these rules we shall again be guided by the dimensions of the crank-pins at present in use and which give good satisfaction. Let us commence with the main rod journal on the main crank-pin; this journal will be the outer one in Fig. 487; it is required to find the diameter *D* and the length *L*. In the eighty-third paper it has been stated that, to prevent a locomotive crank-pin from heating, it must have a sufficient bearing surface, and when such has been provided, the crank-pin will also be strong enough for the work it has to do. These remarks again apply to the main rod journal of the crank-pins, in which the main rod journal is the outer one, as shown in Fig. 487; they also apply to the side rod crank-pin, such as is shown in Fig. 486; but they do not apply to side rod journal on the main crank-pins, as will presently be seen.

Since the pressure per square inch of the projected area of steel crank-pin journals should not exceed 1,600 pounds, we readily find, by Rule 71 (84th paper) the projected area of the main rod journal for consolidation, mogul, and ten-wheeled engines. Thus:

Example 105.—What should be the projected area of the main rod journal on the main crank-pin for a mogul engine having cylinders 18 inches diameter? maximum steam pressure on the pistons is 130 pounds per square inch.

Multiplying the area in square inches of the piston by the maximum steam pressure per square inch, we have:

$$254.47 \times 130 = 33081.10 \text{ pounds},$$

which is the total maximum steam pressure on the piston.

According to Rule 71 we have:

$$\frac{33081.10}{1600} = 20.67 \text{ square inches},$$

which is the projected area of the main rod crank-pin journal.

Before we can find the diameter and the length of this journal we must establish a ratio between the diameter and the length. There are a few engines of the classes now under consideration in which the diameter of the main rod crank-pin journal exceeds the length of the same; and on the other hand we meet with a few engines in which the diameter of this journal is less than the length. But in a large majority of these engines, the diameter of the main rod crank-pin journal is equal to its length. We shall therefore adopt a rule by which we can find the diameter and the length of the journal which are equal to each other. To the diameter so found we shall add, for wear, about $\frac{1}{16}$, or up to $\frac{1}{8}$ inch, so as to obtain such diameters whose fractions, if they have any, are divisible by $\frac{1}{8}$ inch; as for the length, we shall adopt the nearest value which contains fractions that can be divided by $\frac{1}{8}$ of an inch, and this value may be either a little less or a little greater than the length found by the following rule:

Rule 75.—To find the diameter and length of the main rod crank-pin journal. Extract the square root of the projected area, as found by Rule 71. If this square root does not contain any fractions, or if it does contain fractions which can be divided by $\frac{1}{8}$ inch, add to it $\frac{1}{8}$ of an inch for wear; the sum will be the diameter. If the square root contains fractions which cannot be divided by $\frac{1}{8}$ inch add $\frac{1}{16}$ or a little more, so as to obtain diameters which are divisible by $\frac{1}{8}$ of an inch. The square root of the projected

area will also be the length of the pin; if it is not divisible by $\frac{1}{8}$ inch adopt the nearest value which is divisible by $\frac{1}{8}$ inch.

Example 106.—Find the diameter of the main rod crank-pin journal for a mogul engine having cylinders 18 inches diameter, maximum steam pressure on piston 130 pounds per square inch. In Example 105 we have found that the projected area of this journal is 20.67 square inches. The square root of 20.67 is 4.54 inches, which is a little more than $4\frac{1}{2}$ inches, hence the diameter is $4\frac{3}{8}$ inches; and the length is $4\frac{1}{2}$ inches.

The projected area of the side rod journal of the main crank-pin, that is, the inner journal in Fig. 487, as made by different builders, varies somewhat; hence we find that in a number of engines the projected area of the side rod journal is greater than that of the main rod journal; and in a number of engines it is less; but in the majority of engines the projected areas of the two journals are equal, and these latter proportions we shall adopt. Hence the projected area of the side rod journal of the main crank-pin is found by Rule 71.

True, if we had only to make provisions for the prevention of heating, a smaller area would suffice, but, since the outer journal of this pin is subjected to a greater pressure than is brought to bear on the side rod journal, and since pressure on the outer pin acts with a leverage, we require a large projected area so as to provide for the strength of the pin.

The ratio between the diameter and length of the side rod journal, as made by different builders, also varies; but the most common practice is to make the diameter $1\frac{1}{4}$ times larger than the length; and these proportions we shall adopt. We have therefore the following rule:

Rule 76.—To find the length and diameter of the side rod journal for the main crank-pin, when this journal is next to the wheels, divide the projected area, as found by Rule 71, by 5; multiply the quotient by 4, and extract the square root from the product; this square root will be the length of the side rod journal. If this square root is not divisible by $\frac{1}{8}$ inch, adopt the nearest value which can be divided by $\frac{1}{8}$ inch. For the diameter multiply the square root found as above by 1.25; if this product is divisible by $\frac{1}{8}$ inch, add to it $\frac{1}{8}$ inch for wear; the sum will be the required diameter; if this product is not divisible by $\frac{1}{8}$, add from $\frac{1}{16}$ to $\frac{1}{8}$ inch, so as to make it divisible by $\frac{1}{8}$ inch; the sum will be the required diameter.

Example 107.—Find the length and diameter of the side rod journal for the main crank-pin for a mogul engine having cylinders 18 inches diameter; maximum steam pressure on the piston 130 pounds per square inch. The projected area of this journal is, according to Rule 71, 20.67 square inches; in fact, this area we have found in Example 105.

According to Rule 76 we have:

$$\frac{20.67 \times 4}{5} = 16.53.$$

The square root of 16.53 is:

$$\sqrt{16.53} = 4.06 \text{ inches.}$$

Hence the length of this journal is 4 inches.

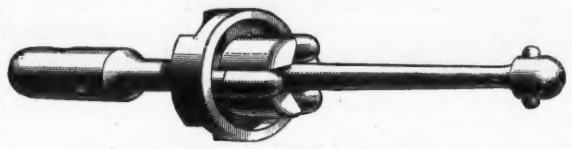
Again for the diameter we have $4.06 \times 1.25 = 5.07$ inches, which is a little more than 5 inches; hence the diameter of this journal is $5\frac{1}{8}$ inches.

An Interesting Relic.

A white pine tree was cut recently two miles south of Shade Mills, Md., near the site of the old Braddock road, and converted into shingles. It was a large tree, and estimated to be at least 300 years old. In cutting it up, the saw going through some tough substance attracted attention, and investigation disclosed a bullet imbedded within two inches of the heart. The tree at this point was thirty-two inches in diameter. About one-third of the bullet was sawed away, the remainder, weighing at least an ounce, being left in the corner of the butt end of a shingle. The ball is supposed to have been shot from a musket by one of Braddock's men during the campaign which culminated in the disaster at Fort Du Quesne. In this event the bullet was imbedded in the tree 133 years ago, each year's growth burying it deeper. It is a most interesting memento of the ill-starred campaign of 1755.—*Baltimore Sun.*

The Tonkin Tube Expander.

The tool which we illustrate herewith is made by the Oswego Tool Co., Oswego, N. Y., and sold in New York by Watson & Stillman, 210 East 43rd street. It is made entirely of steel, except the head, which is of wrought-iron, case-hardened. Each part is made to gauge, and interchangeable. Apart from the pin and rollers, it consists of but one piece—a solid body, into which the rollers are journaled.



THE TONKIN TUBE EXPANDER.

The guard is one-half inch deep, and the body is milled out in three places, so that the operator can see the end of the tube upon which he is working. A groove is turned in the rollers inside the guard, so that a projecting tube will not split while being expanded. The rollers work between guides, as represented in the engraving; this keeps them parallel with the axis of the pin, and enables them to do their work properly without danger of cramping.

The head on the small end of the pin prevents the rollers and pin from coming out, and, there being no loose pieces, the tool is always ready for use; no parts will be found missing.

A Locomotive Builder Uses Some of His Money to Good Purpose.

John H. Converse, of the firm of Burnham, Parry, Williams & Co., the proprietors of the Baldwin Locomotive Works, has about perfected arrangements for the erection of a building, a gift by him to the Presbyterian Hospital. Mr. Converse is one of the trustees of the hospital, and also secretary of the board of trustees. The structure is to be called the administration building, and will cost between $60,000 and $70,000.—*Philadelphia Record.*

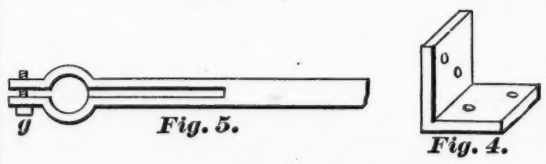


Fig. 5.

Fig. 4.

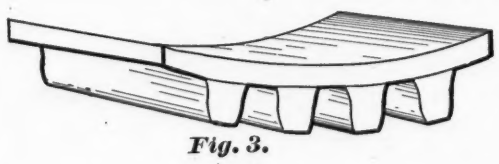


Fig. 3.

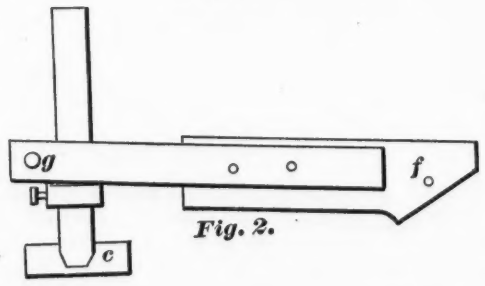


Fig. 2.

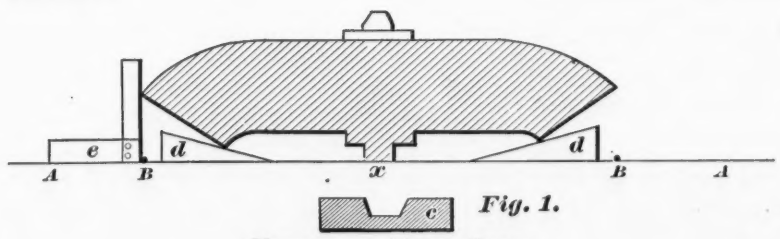


Fig. 1.

MOULDING A BEVEL GEAR.

The Little Giant Wire Cutter.

With this we illustrate a machine intended to fasten to the bench, and to be used for cutting brass, iron, or steel rods of any size up to $\frac{5}{8}$". Instead of having the cutting lever attached to and working upon a bolt or pin, it is attached, by the two bolts shown, to a ring which turns upon a seat provided upon the main casting. Into an opening through the center of this casting, which is bored out to receive it, the die is placed and secured in position by the set screw shown on top. This construction brings the actual center, about which the cutting lever turns, midway between the two bolts and about the lower or cutting edge, and the holes made through the die can be brought as close to the center as may be desired, thus giving a very powerful leverage.

The lever is also held more firmly in position than by the usual construction, and is prevented from crowding away from the face of the die, the result being better work, more easily done. The gauge is adjustable to any length up to 24 inches.

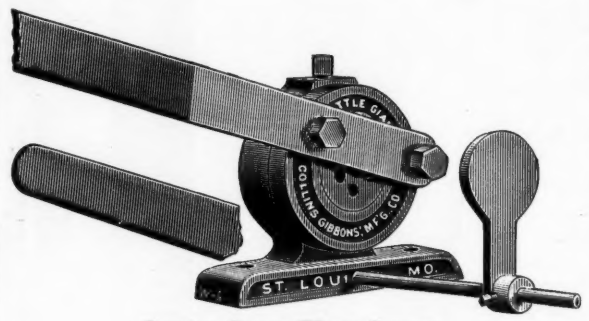
The manufacturers are the Collins-Gibbons Mfg. Co., St. Louis, Mo.

LETTERS TO PRACTICAL MEN.

English and American Tool Steel.

Editor American Machinist:

I have read the editorial entitled "Some Further Points About Steel," in your issue of Feb. 14, and cannot conceive how anyone who has taken a practical interest in this subject for the last 30 years can give an opinion in favor of "American Tool Steel." While great progress has been made, it will be a long time before we succeed in producing the *uniform* quality which the English makers have attained. Only when material can be obtained on equal terms with Sheffield, and help in our country becomes more settled, can we expect first quality of tool steel from American manufacturers.



LITTLE GIANT WIRE CUTTER.

We import much of the material used in its manufacture, and to successfully compete with England it must be obtained free of duty. Another reason why English makers have attained superiority is because, in many cases, each man learns one part of the business and spends his whole life in that place, doing the same work.

I do not deny that *good* tool steel has been made in this country, and have said many times that the results accomplished by steel makers here are wonderful, considering with what they have to contend and how short a time they have been at work. It would, however, require more courage than I possess to recommend a company to change to any American tool steel within my knowledge, especially where from 50 to 75 tons of best quality English steel is yearly put into cutting tools by one manufacturer and sold all over the world. The quality of steel one *uses* in his own shop may not seriously affect his reputation, but when he begins to *sell* cutting tools to others, it is quite another matter, except, of course, where a cheap class of work is made and charged for accordingly.

I have been interested in the use of tool steel for many years and have experimented to quite an extent with different brands of American as well as English: all experimental steel being used up in shop and never in any case put upon the market.

Some may say these statements are not patriotic, or do not tend to promote home industry; but I believe truth carries the largest load and it is best for all in the end.

RICHMOND VIALL.

Providence, R. I.

Moulding a Bevel Gear, Making Teeth Larger Than Pattern.

Editor American Machinist:

The sketch herewith shows the plan adopted for making this gear.

It was a break-down job, the old wheel being broken and worn so badly that it was almost impossible to mould one off of it and make a good casting.

After digging a hole in the floor to admit pattern and have sufficient room to properly bed it in, a spindle was put up, and a good solid and level bed swept up, as shown at *A A*, Fig. 1. A circle, the exact diameter of pattern at outside edge of teeth, was then struck, represented by dots *B B*, Fig. 1, the object of which will be seen before the job is completed. After removing the spindle and placing a piece of waste in seat *c* to prevent the same from getting into it, the pattern was put down and leveled up, keeping it above the bed as shown at *d d*, for tucking purposes, and keeping outside edge of teeth in line of circle *B B*. This is done by placing a carpenter's square on the bed, letting the corner rest at *B*, and placing pattern against it as shown at *e*. This is done so as to have spindle seat *c* in the center of the mould. After putting a weight on the pattern it was tucked (using facing) and rammed up, the cope lifted off, cores taken out and pattern drawn.

The center of hub was then dug out and seat *c* perfectly cleaned, to admit of replacing the spindle, after which sweep *f*, Fig. 2, was attached as shown, and the teeth swept off.

The segment, Fig. 3, was then securely fastened to the sweep with two chairs, Fig. 4, one on either side, to prevent it from springing and getting out of circle. After being sure that the segment rested properly on bed all the way around and tightening set screw *g*, Fig. 5, to prevent moving, the teeth were rammed up with a small rod. The teeth on segment all being rammed up, the set screw *g* was loosened, the segment drawn and moved around, letting the last tooth of segment rest in the last tooth of mould, to serve as a guide. Tighten set screw and ram teeth as before, repeating the same until entire circle of teeth are complete, after which the spindle is removed, mould dressed (using calipers to get core prints (Fig. 1) in center) and closed. X. Y. Z.

About Patents.

Editor American Machinist:

There appear ever and anon, articles in your columns bearing on patents, patent law, inventors, etc., which it is well worth the time of even the industrious inventor to read and well consider, then ask himself if there are not other channels into which he can turn his thought and industry, that offer a better foundation to build on. From the fact that ninety-five per cent., or nearly that, of patents are valueless, it would appear that the question just stated above would be in order. Supposing wealth to be the influencing incentive of the inventor, the chances are that the road to it does not go by way of the Patent Office, but in economy in getting the most for one's labor, in taking advantage of everything that tends to better one's condition,

It has been my fortune to have known a number of inventors, and known many of their schemes, some of which were perfected and patented, while others were not.

The first scheme I will refer to was not only to make the inventor rich, but to put a stop to the devastation of our forests—a thing for which the rising generation would be duly thankful, etc. All this was to be accomplished by cutting up old rails and making ties of them. The tie consisted of two pieces of cast iron bolted between two rails cut the length of a tie; the cast pieces had bent holes cored through them, in which the spikes were to be driven that were to hold the rails to the tie. These cast pieces were made the shape of the rail, and such width, when bolted between the old rails that were to form the tie, that their flanges would almost touch each other. They were also bolted in, the right distance apart, so when the rails were spiked down the track would be the right gauge. When the tie was in position, the flanges would be down and with the track rails resting on the heads of the tie rails and cast-iron pieces. The amount of curve necessary to give the spike holes could be determined by practice; to begin with, they would be made so the spike would drive about as hard as they do in a wood tie. The inventor of this tie, at my suggestion, asked the opinion of a practical railroad man as to the merits of his tie. My own opinion was that he had a good thing, and that it would be a success, at least on western roads, where timber was scarce and old rails plenty and cheap. But the railroader had a very different opinion. He said that the first train over a track laid on such ties would loosen every spike, and that the noise of a train over loose rails on metal ties would be deafening, and that the wear on the metal surfaces would be so great as to condemn it in a short time. This was a severe criticism, but, after watching a train pass, and noting how the ties bob up and down as the weight of a wheel is on or off, it was concluded that his judgment might be well founded. I do not know what the inventor has concluded to do about it. I told him metal ties were largely used in Europe, and that it would not be amiss to investigate it further, for the opinions of even practical men were not always to be *tied* to.

The next invention that I remember was to supplant pumps of every description, except possibly those used for well and cistern use; in fact, I never knew an inventor who was at all backward about telling of the great things his ideas would do when put in practice. It affords them pleasure, and I do not know but what "the pursuit of happiness" includes such pastime. This "pump," as the inventor called it, was to work on the combined principle of hydraulic ram and injector. The water is set in motion by means of a vacuum, and its acquired velocity forces it through tubes into the main at any required pressure. The inventor's idea was that by using a vacuum, only a very low pressure of steam would be required; in fact, "less than no pressure at all would do." He asked my opinion of his pump, saying that he had received some very flattering replies from his patent attorney concerning it. There was nothing very flattering about my opinion, but I do think it contained some elements of truth. In the first place, I doubted very much if there was anything new in his combination, and even if there was, it would be no better nor as good as many pumps in use. I tried to impress the fact that it required just a certain amount of power to raise a given amount of water to a given height, no difference who did it, or by what means it was accomplished, and that precisely the same amount of power would be developed by the water falling. The only thing he could hope to do would be to make something more reliable, cheaper, or work with less friction, so the loss of power would not be so great, and therefore work more economically than pumps already in use. And that steam of high pressure was practically more economical to use than that of low pressure, and that, so far as gaining power was concerned by any means whatever, it was just as impossible as it would be to take a pound of iron and increase its weight by changing its form.

In a few days after the above occurred, I had the pleasure of looking over the drawings of a design of an "improved steam engine indicator" that I was very favorably impressed with. Instead of a piston, this indicator had a diaphragm spring. A lever was attached to it (the diaphragm), and had a very simple parallel motion, owing to the slight travel of the diaphragm compared with that of a piston; it would be necessary to connect the diaphragm very close to the fulcrum of the lever, in order to give the pencil end the usual amount of travel. The area of the diaphragm was the subject of considerable thought; the conclusion arrived at was, to give it two inches of area for every inch of travel of pencil. The object in substituting the diaphragm for the piston was, of course, to avoid the leakage and friction of a piston, which are very objectionable features.

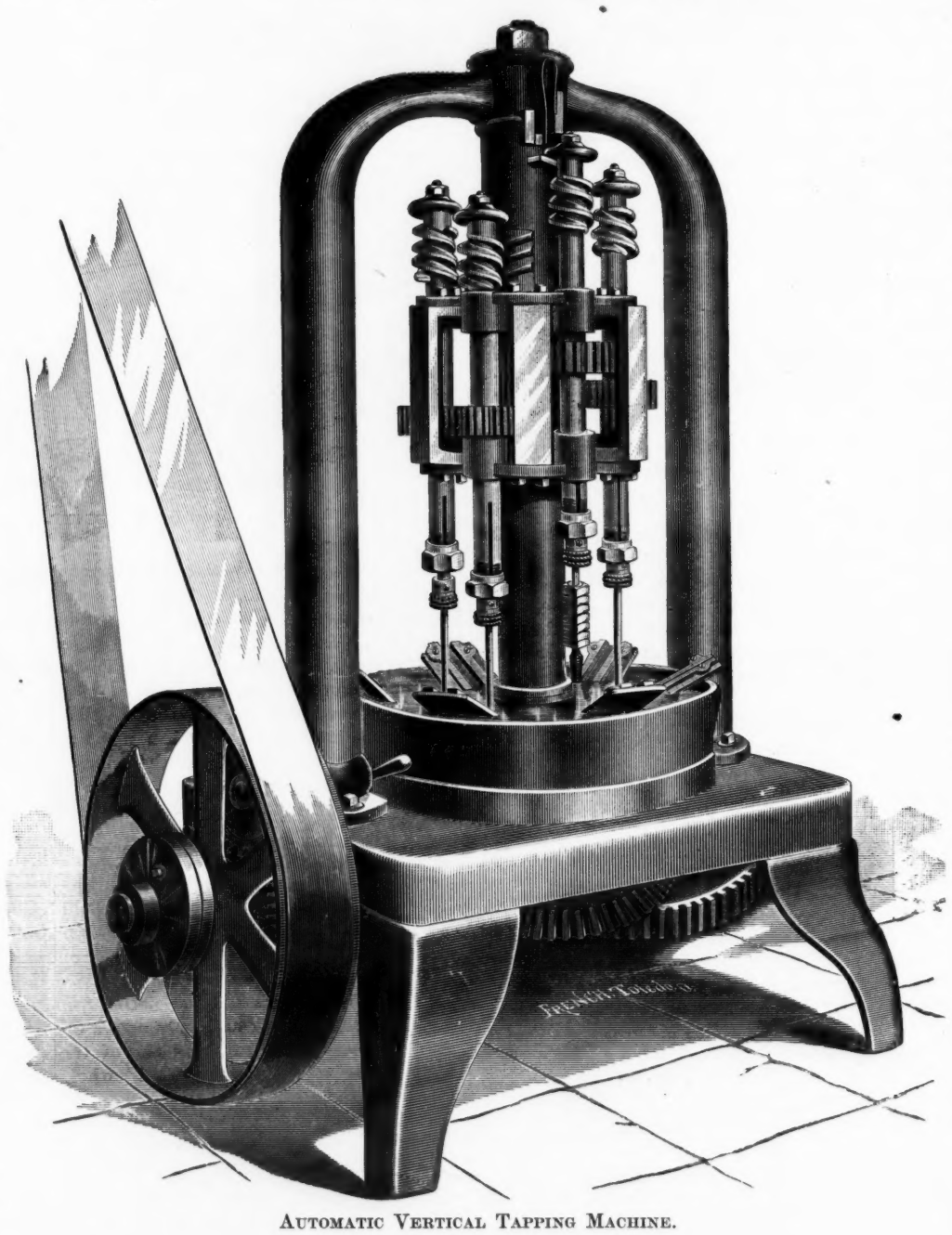
Now it so happened, at the time I speak of, you asked for a copy of No. 2, Vol 2, and in looking for it I found many of your first issues that were very interesting. One in particular (Vol. 2, No. 32), that contained a whole encyclopedia of information on indicators by that prince of writers, "Chordal." I took this copy to my friend and asked him to compare the sketch of Wiegand and Le Van's indicator with his own, and see if he could find any practical difference between theirs and his. I could not. Now, if there is any good reason why an indicator of this kind would not be a good one, I should like to know it, if such information can be had, without the trouble and expense of "working it out." C. O. Sine.

An Objection.

Editor American Machinist:

Your correspondent, "Jar-Yes," seems to put upon me the necessity of intimating to the readers of the American Machinist that I don't mean what I don't say—that is, not always. If he wants to argue that knowledge is of no value, that mental cultivation doesn't pay the young mechanic, that opportunity doesn't generally pick out the best qualified, it might be proper for him to use his own name; but I don't know what mine has to do with it. Frank Richards.

The question is being agitated in Boston of the city owning and operating all public electric light and gas plants.



Automatic Vertical Tapping Machine.

Automatic Vertical Tapping Machine.

The cut shows a large vertical tapping machine, designed for tapping heavy nuts from ¾″ up to 2″, or larger if desired. The object in giving it the form shown is to get rid of the labor of raising and lowering the heavy tapping spindles, which is no sinecure, as they are made of 2⅜ steel, and carry in addition a gear wheel, tap holder, and tap filled with nuts.

The machine revolves before the operator, and raises each tap as it is presented to him, so any person who can handle the nuts is able to operate it. The machine is driven by a belt as usual. The cone or belt pulley is loose on the horizontal shaft, and so arranged that it can be made fast to the shaft for light work, or made to operate said shaft by external back gear for heavy work; this arrangement is similar to that used on the common back-geared lathe.

The speeds are suitable for ¾″, 1″, 1½″ to 2″; the horizontal or driving shaft carries a bevel pinion, which drives a vertical shaft in the center of column. This shaft carries on its lower end, just below the bevel gear, a pinion, which gears into a large spur wheel shown under the bed plate of machine; this is secured to a vertical shaft, which carries another pinion matching into teeth cast in the lower edge of pan, thus causing the pan to rotate at the rate of 1 revolution to 33 of tap spindle. Allowing 30 threads on the tap (which is about the average), there will be some 4 or 5 revolutions left after the nut is tapped in which to change taps, replace nut, etc. Little enough time, but it proves to be sufficient. The vertical shaft in center of column also carries a large pinion with very wide face, into which the 6 gears on the tap spindles mesh; the length of face on the large pinions is great enough to allow of a sufficient amount of end motion of tap spindle to raise the tap out of the nut, and also to allow it to tap clear through the nut.

The top end of each of the tap spindles is a 3″ pitch double-threaded screw, surmounted by a disk; the disk is loose on the spindle, but the screw is keyed to it; on the top of the central column is a sleeve, which is prevented from rotating with the column by an opposing spring on the arch, which supports the top of center column. This sleeve carries on it a spiral rack and flat bench, followed by an incline. As each tap spindle comes around, its screw engages in this spiral rack, which runs it up. When it reaches its highest position the disk on the top of the shaft passes over it and down the incline, the spindle drops down, the tap entering the nut which has been placed for it.

The pan is filled with water within two inches of the top, and has ½″ of oil on its surface; the nut is submerged in oil while being tapped. The spindles are provided with patent tap-holders, which admit of their being removed and emptied when filled with nuts without stopping the machine; the machine is capable of tapping 6,000 to 8,000 ¾″ nuts in ten hours; it weighs 4,500 pounds. The machine is made by the National Machinery Co., Tiffin, Ohio.

The Engineer (London) says:

The Salt Union is not to be without competition. In addition to the new works at Winsford, recently started, twenty-seven acres of land have been purchased within a few hundred yards of the Salt Union brine shafts, and operations for sinking a shaft have been commenced by a London syndicate. On adjacent land another similar venture has been started, a body of Widnes chemical manufacturers having bought what is known as the Witton Hall estate for a like purpose.

Well, there have been a good many ventures in oil in this country since the Standard Oil Company set out to control the market, but they all gravitate to the Standard as naturally as water runs down hill. Perhaps our neighbors across the water will find corresponding conditions in salt.

The young girl in Anderson county, who, by her own efforts, made two bales of cotton last fall, in order to pay for her schooling, is worth her weight in gold. If there was more work and less dress parade about our girls in town and country, there would be less complaint of hard times. Working girls are the jewels of the country. Lazy and trifling men, young and old, are drones and positive evils to society.—*Augusta (Ga.) Chronicle.*

Societies similar to building and loan associations are in some parts of the South operated to furnish money for building factories. The money comes from the association funds to build the factories just about as it ordinarily comes to build houses.

Main's Hot Blast System for Steamships.

The long routes made by the steamships of the U. S. & B. M. SS. Co., the routes extending through tropical seas (crossing the tropics four times and the equator twice, out and home,) and also the heavy cost of fuel in Brazil, necessitated decisive and intelligent action on the part of Capt. J. M. Lachlan, General Manager of this line, so as to enable him to reduce the cost of fuel. Capt. Lachlan is also intrusted with other heavy interests in steam shipping, and he deems it his first duty to take good care of the cargo entrusted to the companies in which he is interested, and thus secure the deserved support of the shipping public, and hold their custom. The SS. "Advance," belonging to the U. S. and Brazil Mail SS. Co., runs from New York to Rio Janeiro, Santos, and return, a distance of about 5,787 miles each way. The coal consumption on this steamer used to be 37 tons per day. Capt. Lachlan reduced this consumption to 32 tons per day for the same speed and pressure, by applying to the boilers a device called the Marine Generator and Circulator, which is not shown in our illustrations. Finally the coal consumption was reduced to 22.2 tons per day; this was effected by using Main's Hot Blast system, of which we give illustrations. But a reduction in coal was not the only advantage gained; the cargo was, on its arrival in New York, in a great deal better condition than it ever had been at the end of any voyage.

The description of this apparatus is as follows: *A* represents two double-ended boilers with six furnaces in each; *B* represents the air heater, placed at the base of the smoke pipe; *C* represents the positive blower on the lower deck, adjoining the engine room; *D* represents the ventilating pipe conveying the air from the holds, fire rooms, coal bunkers, saloons, etc., to the blower; *E* represents a series of heating pipes in the boiler connections, leading the air from the air-heater to the furnaces, and *F* represents the construction of the hollow furnace front, for the admission and regulating of the hot air, to the furnace and ashpit.

The following results with this system of hot blast were obtained during the return voyage of the SS. "Advance." The running time was 500 hours; bituminous coal consumed, 470 tons; revolutions per minute, 64; steam pressure, 80 pounds; I. H. P., 1,438, and coal per I. H. P. 1.4 pounds. The hot air was delivered to the furnaces at a temperature of 250° and the waste gases in the smoke pipe were discharged at a temperature of 440°. The value of drawing the vitiated air out of the holds, saloon, coal bunkers, fire-room, and engine room, is in the fact that a constant current of pure air is kept circulating through the ship, and consequently stopping the precipitation of condensation (or what is commonly called sweat) in the holds. This was fully borne out by the pure atmosphere in the holds during the voyage, and the dry, clean condition of the coffee and cocoa bags when discharged. Of course the usual ventilators into the ship's holds sent in a constant supply of pure air. The positive blower draws the impure air out of the holds and throws it into the furnace, and it is burnt there. Again, the heat in the smoke-stack before the application of the system was 670°; now it is held at a maximum of 440°, and at the entering of the furnaces never less than 250°. The combustion of coal was slower, being more perfect, as the exact quantity of air to produce the same was forced in. The air pressure by water test, before entering the heater at the base of the smoke-stack (forced by blower) was three inches, and at furnace door three-quarters of an inch, these pressures giving all the steam required at a pressure of 80 pounds, and a speed of 12 knots. These results were more than expected by Capt. Lachlan, and he has therefore ordered to fit all the company's ships with the same apparatus. Indeed, where a compound engine develops the indicated horse-power as stated, and only consumes 1.4 pounds of coal per I. H. P., it is fair evidence that this system is successful, and a common-sense one. At the way-ports the engines were stopped, the blower was also stopped, and the dampers and furnace doors all tightly closed; then the steam was held until the departure of the ship, and thereby the blowing off steam, the burning of coal, and the expansion and contraction of the boilers (causing leaks) were prevented. Again (owing to the forced blast), steam was easily kept up in the tropics when there was no breeze, and so the maintenance of steam was found to be entirely independent of the condition of the atmosphere. It may also be remarked that, during the voyage, the boilers were remarkably tight, which is thought was due to the closed furnaces, hot air supply, good circulation, and the absence of cold air draught in the furnaces and tubes; all these causes produced a uniform temperature of the boilers, and so prevented leakage.

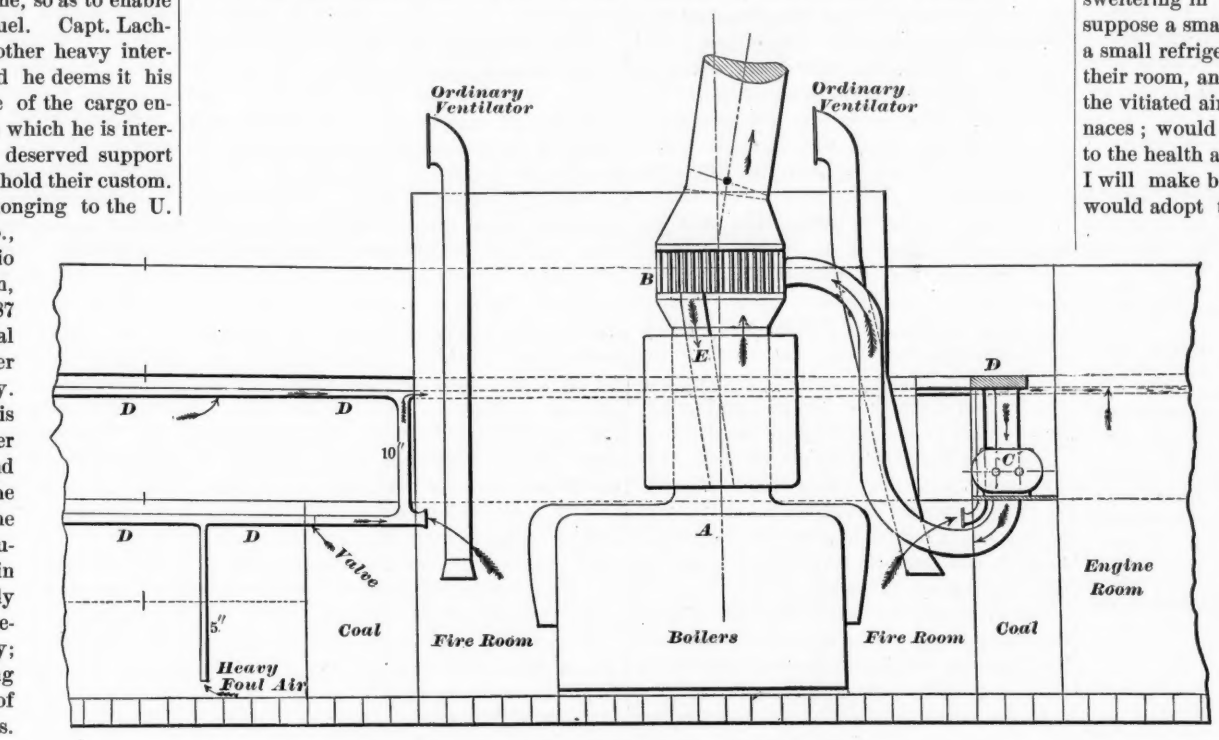
In a letter to Mr. B. Waymouth, Sec'y Lloyd's Register of British and Foreign Shipping, Capt. Lachlan makes the following remarks: Suppose this system (Main's Hot Blast) on board a large emigrant ship, in heavy or rainy weather, when the people have to be battened down. As long as the usual ventilators send air down into the steerage the Root's positive blower will draw the vitiated air out, and the people will be breathing pure air always, and you pull that bad air out and burn it, and all the volatile gases that escape from coal as cargo or bunker coal, you pull out and burn, and keep a pure supply there.

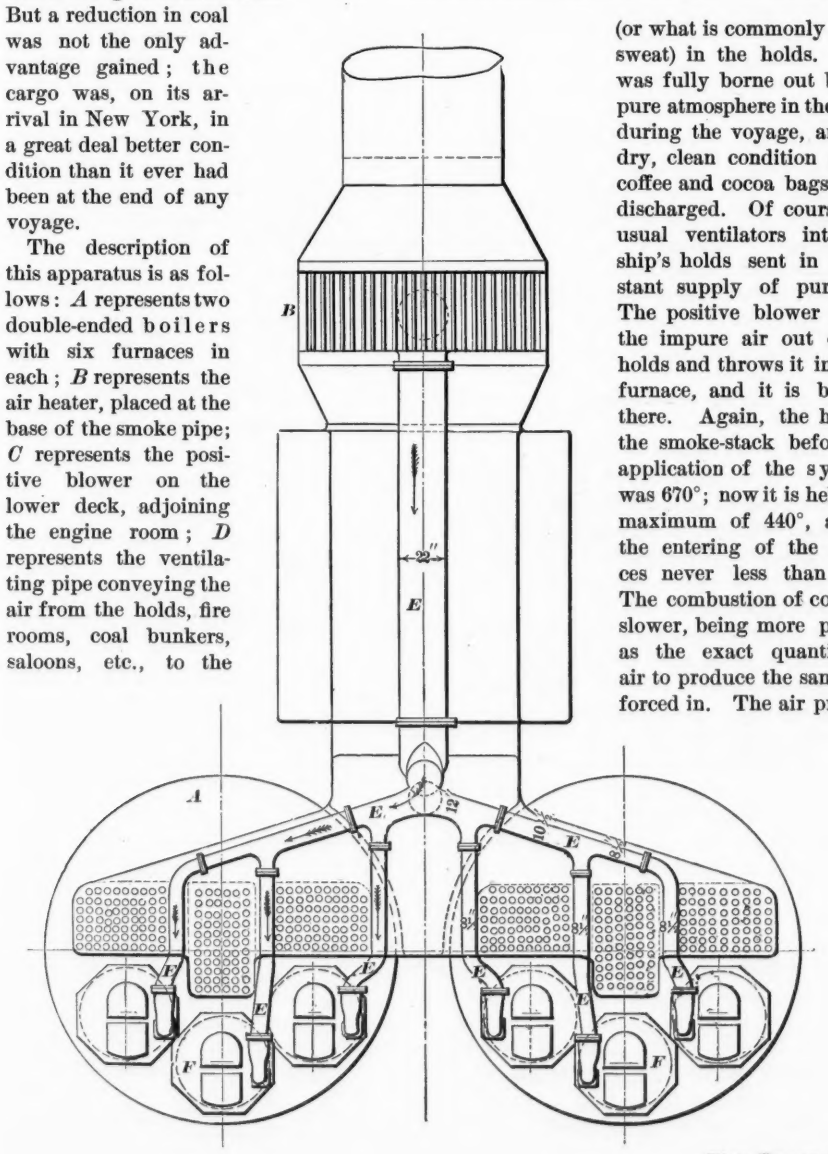
"Again suppose a petroleum loaded ship—all the gases that escape from the same can surely be pulled out and sent flying into the furnaces and burnt; no fear of an explosion in your pipes in the breechings, as you mix the hold air with air pulled out from other places. Recollect that at the heater at base of smoke stack the water pressure is 3 inches, showing a rapid and strong flow of air.

"Do you think that the French steamship that blew up the other day at Calais, loaded with petroleum, if she had had a positive blower, pulling the escaped gases out, would have met the end she did, and the loss of life that occurred? I do not think so.

"These hold pipes are not expensive (No. 16 galvd. iron) with registers some 10 or 12 feet apart.

"Again, take a passenger ship in the Red Sea, where the passengers are, so to speak, sweltering in bed at night with the heat; suppose a small blower drove air sent through a small refrigerator (cooled air low down) in their room, and the upper pipes pulled out the vitiated air and sent it flying into the furnaces; would it not conduce most materially to the health and comfort of the passengers? I will make bold to say that the line that would adopt this system, as I see it, would not be able to carry all the passengers that would offer. In the case of crowded troop and hospital ships it would be most invaluable."

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AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY
BY
American Machinist Publishing Co.
96 Fulton Street, New York.

Horace B. Miller, Pres't and Bus. Manager.
Lycurgus B. Moore, Treas. and Sec'y.

F. F. Hemenway, Editor and Mech. Engineer.
J. G. A. Meyer, Fred J. Miller, } Associates.

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"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 Bouverie Street, Fleet Street, London, Eng., will receive subscriptions for the American Machinist, at 14/7 per annum, postage paid.

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NEW YORK, MARCH 7, 1889.

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The Steel Question.

We publish this week among the "Letters from Practical Men," a communication from one who occupies a position of responsibility in an establishment which uses tons of tool steel yearly, and in which we know that results are very closely and systematically watched.

Our correspondent's experience has led him to a conclusion regarding the comparative merits of American and English steel diametrically opposite to the view taken in our editorial of Feb. 14. The letter needs no apology, either from the writer of it or from ourselves. It is, we believe, the honest expression of an opinion founded upon practical experience, and as such is entitled to consideration.

We have no desire other than that the truth shall be arrived at, in this as in all other matters, for we believe, as our correspondent says, that the truth is best for all in the end. If the only reliable tool steel to be had in this country is that which is imported from England, then we believe it is for the best interests of the vast majority of our readers to be made aware of the fact. As we said in our first article upon the subject, we regard the matter of the selection of the best possible steel for the given purpose as one of prime importance. We think that our position as a manufacturing nation, and the degree of success which we shall attain in competition with other manufacturing countries, depends to a considerable extent upon the quality of the tool steel which we may be able to obtain and use.

So far as the question of patriotism enters into the matter, we believe it consists in seeking the greatest good of the greatest number, and this we imagine can best be done by furnishing our American manufacturers with the best steel obtainable, regardless of its origin.

But it is our opinion, as a result of our own experience, that American steel can be had which is fully equal to English steel, and we cannot, of course, be expected to forsake a conclusion drawn from our own experience, simply because some one else from his experience has drawn a different conclusion.

Every mechanic will naturally, and, we think, properly, be guided in such matters mainly by his own experience, and our principal object in calling attention to the subject in the first place, was to induce those who, from prejudice or some other cause, had had little or no experience with the best American steel, to acquire that experience by a full, fair and intelligent trial.

We know of a number of establishments in which American and English tool steels have been given thorough and practical tests side by side and a conclusion arrived at favorable to the American steel.

In one of these places dental tools are made—a class of work in which the quality of the steel used is of supreme importance, and in which the cost of the steel plays an unimportant part compared with the entire cost of the finished tools; thus giving little inducement to seek mere cheapness of steel.

Thorough tests continually made in this establishment, with special devices for the purpose, and solely with the object of finding the best obtainable steel for the purpose, have demonstrated the superiority of a certain American steel over any other steel obtainable.

It is true that our best American tool steel is made of iron which comes from Sweden, and that, so far as known, there is no iron produced elsewhere from which steel of equal quality can be made. Our American steel makers pay a heavy import duty upon this iron, while the English steel makers import it free. But while this undoubtedly affects the cost of the steel, we think no one will assert that it affects its quality, so long as the iron is imported and used.

Our English Friends.

In our issue of Jan. 3 we took occasion to draw a comparison between English and American workmen, found in our American shops, and attempted to show what influence this might have upon the methods of manufacture in the two countries. We simply mentioned these differences, without saying or intending to imply that on account of them the one was a better mechanic than the other. But we seem to have touched a tender spot in the breast of one of our English contemporaries, which seems to consider itself called upon to defend the British workmen from what it wrongly imagines to be an attack.

After unjustly accusing us of doing various unpleasant things, "sneering," among the others, it makes the statement that "the backbone of American manufactures is to be found in the presence of skilled British workmen in the workshops of the States."

Now we know of many highly skilled workmen in our shops, who have come here from England, but we never suspected them of constituting the backbone of our manufactures. We know perfectly well that English mechanics bring mechanical knowledge to this country which is valuable to us, but, on the other hand we also know that the English mechanics usually find much to learn on coming here, and also that those who have been here and tried it are usually free to acknowledge that fact. In this connection it may not be amiss to call the attention of *Ironmongery* to the fact that, not long since, an English firm of machine tool builders advertised in this paper for English fitters and turners returning home who had worked in this country on fine machine work. We do not pretend to say that this proves that English machinists must come here in order to make highly skilled workmen of themselves, but we think it does show that something can be and is usually learned by English workmen in American shops. We have no doubt, either, that most American workmen might learn some things by working for a time in English shops, or in the shops of almost any foreign manufacturing country, for that matter; only it is not so likely to be tried, because the incentive to immigration is lacking, and immigration brings us most of the knowledge which might be gained in that way. It as illy becomes nations as individuals to claim to "know it all."

Fire Insurance.

We have received from Mr. C. J. H. Woodbury the report of the Boston Manufacturers' Mutual Fire Insurance Co., and the joint report of the Associated Factory Mutual Insurance Companies, the latter comprising nineteen mutual companies located in New England and Pennsylvania.

Both reports contain matter which can hardly fail to be of great interest to the owners of manufacturing plants. That part of the report which treats of the cost of insurance and of the effect upon this cost of concerted efforts by all the companies interested in reducing to the minimum the risk of fire, is especially suggestive. This concurrent action began in 1878, and resulted in the lowering of rates 5 cents to 25 cents on each $100 of risks carried, and at the same time there was a steady increase in dividends paid to members. The total gain to members in concession of rates and increased dividends being estimated at not less than $5,000,000 for the ten years—1879 to 1888 inclusive—a sum which far more than covers the estimated cost of the improvements and additional safeguards called for.

The actual cost of insurance for twelve months is placed at 30 cents per $100, and it is stated that, "according to the experience of the last few years, the cost of general and special inspection, making plans, printing and distributing documents, making special investigations of oil, hose, sprinklers, etc., etc., comes to one hundred and fifty dollars per year on each million dollars of risks insured." This expense is apportioned among the various companies in proportion to the risks carried by them.

The report on automatic sprinkler protection, by Mr. Woodbury, is very instructive. It embraces the period from 1877 to 1888 inclusive. The claims paid on fires occurring in factories without this protection averaged $17,343.94 for each fire. The claims paid for fires occurring in factories having automatic sprinklers averaged only $3,382.57, and even this is not as good a showing as would be made if the report covered only a few of the most recent years, because the automatic sprinklers have within that time been improved in sensitiveness and reliability.

In the matter of hose used in factories for fire protection, it has been found, as the result of a special investigation, that a great deal of it is utterly unfitted for the purpose it is supposed to serve, and that some of it is not made for the purpose of extinguishing fires. This is clearly shown by the fact that agents of the associated companies, sent to hose manufacturers to ask for prices, were in more than one instance asked "*whether they wanted hose for actual use in a fire department, or hose only to be put up in order to satisfy an insurance inspector?*"

Much valuable information is given regarding the selection, care and use of hose, it being especially emphasized that factory hose should always be full size (2½ inches), not only because this makes the fittings interchangeable with those of the city departments, but because a far greater proportionate efficiency is attained by the larger size, owing to the smaller frictional resistance, and also to the much greater effect of heavy streams of water which penetrate through the flames or heated gases and reach the coals or source of the fire, instead of being dissipated by evaporation before reaching it.

On the question of friction the report says: "The influence of a slight difference in the diameter of hose on the loss of pressure by friction within it is far greater than is generally supposed. Thus, for any definite number of gallons per minute flowing, the loss of pressure due to friction per 100 feet of hose, whose diameter is 2¼ inches, is 70 per cent. more than in hose of the same smoothness whose diameter is exactly 2½ inches, and the loss in hose just 2 inches in diameter is three times as great as in that which is 2½ inches."

The effect of various degrees of smoothness in the inside of hose is also considered, as well as various forms and sizes of nozzles. Altogether these reports confirm our previously held opinion, that these companies are upon the right track regarding fire protection and insurance.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(101) J. G. G., Chambersburg, Pa., asks: Where can I procure A. E. Seaton's Manual of Marine Engineering? *A.*—It is published by C. Griffin & Co., London, England. You may procure it in this country from any dealer in scientific books.

(102) J. M. R., Sherbrooke, Canada, asks: Please give name of book which will give me instructions in working magnetic ore, to convert it into pig-iron. *A.*—Probably the treatise on Steel and Iron, by W. H. Greenwood, will be of service to you.

(103) H. B. S., Hancock, Del., writes: I want to be a machinist. Will you please tell me what studies I should take up? I have got through with arithmetic. *A.*—Take up the study of elementary geometry; and study the articles on Practical Drawing, now being published in the American Machinist.

(104) G. D. G., Corry, Pa., asks: What is the difference in the tractive power or adhesion between chilled wheels and steel tired wheels for locomotives? *A.*—The adhesion of steel tired wheels will be greater than that of chilled wheels. We have no data of any experiments made with a view of ascertaining the difference.

(105) If F. D., Bellows Falls, Vt., will use finely pulverized spelter solder instead of silver, letting it flow into the joint when it melts, we think he will have no trouble in brazing his copper wire. Use borax mixed with water for a flux. Any kind

of heat, hot enough to melt the spelter will do. For small wire a pair of hot tongs are good, but the blow pipe will answer.

(106) W. C. G., Valparaiso, Ind., asks: What is the philosophy of the statement made by barbers, that sometimes, when a razor is not sharp enough to cut, they lay it aside, and after a long time, when they take it up, it will cut? Please give full theory. *A.*—We do not know whether razors get sharp by being laid away or not, and if they do, we do not know the reason for it.

(107) D. K. E., New Haven, Conn., asks: In cutting tin with punch and die, which is most advantageous, to have the die hard and the punch soft, or both punch and die properly tempered? *A.*—We believe it is the general practice to use a soft punch. A better fit is obtained where the shape is irregular and the punch has a tendency to spread out at the end and fit the die closely.

(108) G. B., ———, writes: Please inform me how to take up the wear of the live spindle of a lathe, horizontally and vertically to make it bore a parallel hole? *A.*—After determining in which direction the spindle must be moved to bring it in line, it will be necessary either to put in shims to move the boxes, or make new ones. A method of determining which way it must be moved is given in our issue of May 12, 1888.

(109) J. K. H., Cleveland, Ohio, asks: Is it necessary to have, for blue printing purposes, ammonia citrate of iron and ammonia besides? If so, what kind, and how much? *A.*—Dissolve 2 ounces of citrate of iron and ammonia in 8¼ ounces of water; also dissolve 1⅛ ounces of red prussiate of potash in 8¼ ounces of water; when the two are dissolved mix them in a dark bottle and keep it in a dark place for future use. Ask for the chemicals as here given, and accept no others for a substitute.

(110) J. C., Stellarton, N. S., asks: Can you tell me of anything better than lead for heating small articles to temper them? I have heard that a mixture of equal parts prussiate of potash and common salt was better. *A.*—Such a mixture as you name is used to some extent, though lead is usually employed, and we think in most cases, if not in all, is as good, if not superior. The main thing in heating steel is to put the right amount of heat into it without altering it in any other way. A lead bath is an excellent way of doing this.

(111) J. W. B., ———, writes: In the shop which I have charge of, and in which I am endeavoring to lower the cost of production, the owner furnishes me with common emery wheels for tool grinding, claiming that they are as good as any other. I claim that if he will furnish me with a grindstone or corundum wheels I can reduce the cost of tool dressing 30 per cent., and do better work. Please give your opinion. *A.*—If you mean common emery wheels used dry, we think you are unquestionably right. Within the past few years, however, there have been introduced special tool grinders, which use emery wheels with water. Being made especially for the purpose, they are very efficient machines for the purpose, though probably not more so than the best grindstones, mounted equally well, run at the highest safe speed and kept true.

(112) C. E. W., Turnwater, Wash. Ter., writes: Please explain by what law of natural philosophy can the fact (?) that gases sometimes spend their forces in one direction only be explained? I stand against Chambers' Encyclopedia, which says nitro-glycerine expends its force "in the direction of those points in actual contact with the compound." *A.*—Such a thing admits of no explanation, simply because it is not true. Gases, in expanding, exert their forces in all directions equally. The *force* exerted by an explosion should not be confounded with the *effect* of an explosion; for, while the total force developed by the explosion of certain amounts of two different explosives might be the same, the visible effect might differ greatly on account of the difference in the character of the explosives. A quantity of gunpowder laid upon an iron plate and exploded might not injure the plate in the least, while a quantity of nitro-glycerine sufficient to develop an equal total force might destroy the plate. The reason for this is, not that gunpowder expends its force upwards, and nitro-glycerine downwards, but that the former is much slower than the latter, and takes time to expand against the pressure of the atmosphere. Nitro-glycerine is sufficiently packed by the pressure of the surrounding atmosphere, and objects at some distance from it are protected by the intervening cushion of air: but it does not follow from this that the force is expended in the direction of the points in contact only. The law of action and reaction applies to the force exerted by gases expanding, as well as other forces.

(113) T. E. W., Marquette, Mich., writes: We have a valve in the bottom of a water tank which is 16 feet high and about 18 feet in diameter. The valve is like the sketch enclosed. As you will observe, it is a common clack valve made of cast-iron, with a rubber gasket fastened in it to make a joint with the seat. This valve opens to an angle of a little over 30 degrees, and cannot open further. Now, when it is opened and then let down suddenly, it will rebound and fly open, and if let alone will keep bounding up and down indefinitely. The only way to stop it seems to be to hold it up for a moment and then let it back down gradually. Often in doing this, the water will force it down so powerfully as to jerk the rope out of a man's hand, by which the lever is lifted, and it will then keep pounding until stopped. When it is bounding, if one forces the lever down, it is difficult to keep it down, the valve bounds back so forcibly. The pipe under the valve is about five feet long, and leads into the open air; its diameter is some eight or nine inches. An attempt was made to stop this by providing a hole to let air under the valve, but this does not seem to help it much. Can you explain what it is that causes this, and tell me how it can be prevented? *A.*—If the sketch shows the correct proportions, or nearly so, we should say the rubber gasket is too thick, which will give the valve a greater power for rebounding than if the rubber were thinner. We also notice that the valve seat is perfectly flat; we should make it slightly conical, so that the valve seat will form an angle, say of about 15 or 20 degrees with the axis of the valve; shape the rubber gasket to suit the valve seat, and do not make it so thick as it is now.

(114) G. E. D., Washington, D. C., sends us two sketches of lever safety valves. One sketch is marked *A*, and represents the ordinary arrangement of a safety valve lever, that is to say, the valve is between the fulcrum and the weight. The other sketch, marked *B*, represents a safety valve lever with the fulcrum between the weight and the valve; in this case the valve is pressed upwards instead of downwards. In both cases the distance between the valve and fulcrum is 1½ inches, and the pressure on the valve is 196 pounds. In sketch *A*, the distance from the center of the valve to the center of weight is 12½ inches, making the total distance from the fulcrum to the center of weight equal to 14 inches. In sketch *B*, the distance from the fulcrum to the center of weight is 12½ inches. In connection with these sketches he says: In sketch *A* a weight of 23½ pounds is required to balance 196 pounds' pressure on the valve, and asks: Will the same amount of weight be required in sketch *B* to balance the same amount of pressure? *A.*—From the tone of your letter, we assume you simply wish to ascertain the weight on the lever, without taking the weight of lever and valve into account. Hence, leaving the weight of lever and valve out of consideration, we have the following rule, which is applicable to both cases. Multiply the pressure on the valve by the distance from the center of the valve to the fulcrum, and divide the product by the distance from the fulcrum to the center of the weight; the quotient will be the number of pounds required to balance the pressure on the valve. Thus, in sketch *A*, the distance from the center of the valve to the fulcrum is 1½ inch; hence we have

$$196 \times 1.5 = 294 \text{ pounds.}$$

The distance from the center of weight to the fulcrum is 14 inches; and

$$\frac{294}{14} = 21 \text{ pounds,}$$

which is the weight required to balance the pressure of 196 pounds in sketch *A*. This result shows that you have made a mistake in your calculations. In sketch *B* we again have a distance of 1½ inch between the fulcrum and the center of valve, and since the same amount of pressure is to be balanced, we have, as before, $196 \times 1.5 = 294$ pounds. But in this sketch the distance from the fulcrum to the center of weight is 12½ inches, hence, we require in this case

$$\frac{294}{12.5} = 23.52 \text{ pounds to balance the given pressure.}$$

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Duplex Gear Cutters. R. M. Clough, Meriden, Ct.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Berryman Feed Water Heater and Purifier. Benj. F. Kelley, 91 Liberty street, New York.

Drop presses, punches and shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Power measured with guaranteed Dynamometers. Franklin Van Winkle, 91 Liberty st., New York.

New Catalogue of Screw Plates, Taps, Dies, etc., just issued by S. W. Card & Co., Mansfield, Mass.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Fire Brick and Clay Retorts; large variety; special shapes to order. Borgner & O'Brien, Philadelphia.

"How to Keep Boilers Clean." A 96 page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing, for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Brown & Sharpe Mfg. Co., have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

Upright drills, improved, sizes 21", 23", 25", 28", 32", 36" swing; finely made and great capacity. Currier & Snyder, Worcester, Mass.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Feb. 14, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

With my Vacuum System, Exhaust Steam Heating costs nothing for fuel; Live Steam Apparatus altered to Exhaust. Satisfaction guaranteed. Geo. A. Barnard, 15 Cortlandt street, New York.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

The Vance Lightning Flue Cutter is *the* tool for removing old flues from boilers and locomotives (will cut fifty an hour); sent on approval to railroad companies. Vance Tube Cutter Co., Geneva, N. Y.

A system of easy lettering, by J. H. Cromwell, giving 26 forms of alphabets. The space to be lettered being divided into squares; simple and effective. Price 50 cents. Catalogue of books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Feb. 14, 1889 issue, 70 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 84 articles have thus far appeared up to and including the Feb. 7, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

J. E. Williams, St. Louis, Mo., will increase his machine shop facilities.

W. S. Williams expects to build a merchants' rolling mill at Anniston, Ala.

The Missouri Electric Light and Power Co. will erect a plant at St. Louis, Mo.

Sanders & Waddell contemplate building a woodworking factory at Dalton, Ga.

The Ogilvie elevator and rolling mills at Montreal, Canada, were recently destroyed by fire.

A. F. Cole is interested in a stock company to build a furniture factory at Tallapoosa, Ga.

The Henderson Steel and Manufacturing Company is enlarging its plant at Birmingham, Ala.

The E. J. Riley Manufacturing Company has been chartered to manufacture furniture at Chicago, Ill.

C. & D. R. Kline have purchased the machine shop and foundry at Gainesville, Ga. They will enlarge the works.

R. P. Mosely has formed a company to build a foundry at Hyde Park, Mass. Work on the foundry will be begun April 1.

The citizens of Marshall, Texas, are trying to raise $40,000 to secure the location of the shops of the Paris, Marshall & Sabine Pass Railroad.

The Laredo (Texas) Improvement Company, who have the franchise for the erection and operation of a street railway in this city, have decided to operate the line by electricity.

Hitchcock & Atwood have bought out D. T. Libby's carding mill at Phillips, Me.; they will raise and enlarge the building, and put in machinery for woolen manufacture.

Work has been commenced on the erection of the new plant of the Union Steel and Iron Company at St. Joseph, Mo., and it is expected to be ready for operation by May next.

The Manchester Manufacturing Company has been organized, to build a $200,000 mill at Aiken, S. C. The company will manufacture yarns, knit goods, threads and rope.

P. J. McArdle has come into possession of the old Jagger works, Albany, N. Y., and proposes to form a company with a capital of $500,000, to put in machinery for a rolling mill.

The Betts Machine Company, Wilmington, Del., has issued a pamphlet descriptive of horizontal boring and drilling machines made at the works. The machines are well illustrated and quite fully described.

The Burlington & Missouri River Road will build during the present year repair shops at McCook, Neb., to cost $80,000, and which will give employment to from 800 to 1,000 men.

North Tiverton, Mass., wants a cotton mill, and will contribute land and subscribe for stock enough to put in the foundation and build the structure, if stock enough is taken to furnish the machinery.

H. Blakeney, of Dallas, Texas, will build a two-story building 50x100 feet, to be used as a factory for bed springs, mattresses, cushions, etc. He will furnish employment to between 75 and 100 operatives.

The Chicago Exhaust and Blowpipe Company is incorporated at Chicago, Ill., capital stock, $200,000, for the manufacture of dust separators, furnace feeders, iron pipe, exhaust fans and blowers, and all kinds of sheet-iron work; incorporators, W. E. Allington, W. H. Curtis, and H. S. Towle.

Volney W. Mason & Co., Providence, R. I., have issued an illustrated catalogue of friction pulleys, friction clutches, hoisting machinery, elevators, etc., made at their works. The catalogue also contains a long list of references to those using their machinery.

A meeting of the stockholders of the Henderson Steel Manufacturing Company will be held at Birmingham, Ala., on the 25th of March, for the purpose of considering a proposition to increase the stock to the extent of $40,000, with the view of enlarging the plant.

The Smith Premier Type Writer Co., Syracuse, N. Y., send us a circular of the new type writer brought out by that company. This type writer, it is claimed, possesses many improvements over such machines as previously made, and its points of excellence are fully set forth in the catalogue.

There is water-works agitation at Horton, Kan.; Milledgeville, Ga.; Waxahachie, Texas; Somerville, N. J., Bellefontaine, Ohio; Fostoria, Ohio; Creston, Iowa; Fort Dodge, Iowa; Delphi, Ind.; Amsterdam, N. Y.; Anniston, Ala.; Olean, N. Y.; Cattlesburg, Ky.; Hopkinsville, Ky.; Paris, Ky.

The Page Belting Co., Concord, N. H., has issued its 1889 catalogue of belting and lacing. The catalogue contains a cipher code, and a good deal of information of value to those buying or using belts. The catalogue contains a new list, considerably different from the "Old Standard List."

Messrs. Carnegie, Phipps & Co., are enlarging their wire nail plant at Beaver Falls. After testing different makes they have placed an order for fifty machines with the National Machinery Co., of Tiffin, Ohio. There is every probability this order will be extended, although the imported German machines, and others, are much cheaper.

The Long & Jervis Foundry and Machine Company have removed from Decatur to Florence, Ala. Contracts have been made for three buildings; the machine shop being 50x100 feet; foundry, 50x90 feet; blacksmith shop, 30x50 feet. The capital of the company is $25,000. A specialty will be made of architectural iron work and machinery of various kinds.

A mining corporation, with a capital stock of $300,000, has been organized in Birmingham, Ala., as the Pearson Coal, Iron and Railroad Company. The object of the company is to mine coal and to manufacture coke, iron and steel. The property to be developed by the company is in the vicinity of Warrior. The charter also grants the right to construct and locate railroads, build houses and otherwise improve their property.

The machine shops, car shops and engine house of the Cincinnati, Indianapolis, St. Louis & Chicago Railroad were recently destroyed by fire. The loss to the railroad company's property was complete, and estimated by President Ingalls at $200,000, upon which there is insurance of about one-half. The machinery and buildings were valued at $150,000. There were two locomotives in the repair shops, and three coaches in the car shops.

The *Troy Press* says: The works of the Edison Machine Company at Schenectady at present employ 750 men, but additions which it is proposed to make to the present plant will greatly augment the number of employes, and add materially to the industrial prosperity of the city. The company is negotiating for the purchase of eight acres of ground in the vicinity of the present works, and on the land there will be erected several large buildings, so that the business may be greatly increased.

Noble & Cooley's drum factory at Granville, Mass., recently destroyed by fire, threw out of employment 100 hands. The fire is supposed to have originated in the boiler room, and spread so rapidly as to prevent anything being saved except a few articles of light value in the paint shop. The main building was three stories high, built of wood, and was supplied with valuable machinery. Power was furnished by a water wheel and a sixty horse-power engine. The firm was prosperous, and will probably rebuild.

S. D. Warren & Co., the Cumberland Mills [Me.] paper manufacturers, have some big developments in prospect. They will build a large addition to their already extensive factory, an addition that will much increase its capacity. The new building is to be about 150x100 and two stories, and contain two or more paper machines. The change will bring with it considerable alteration and improvement in the old mill. The material for the new mill is in preparation, and work on the foundation will begin as the river is low enough to admit it. Some sweeping changes in the processes of manufacture are intimated, in particular a new method of cleansing the rag material, in which electricity is to be an agent. —*Industrial Journal.*

Machinists' Supplies and Iron.

New York, March 2, 1889.

Iron—American Pig.—No new features have been developed during the past week. Current consumption steadily absorbs a large amount, but the supply is still largely in excess of demand. We quote Standard No. 1 Foundry at $18; other brands at $17 to $17.50, No. 2 Foundry, $16 to $17, and Grey Forge at $15 to $15.50.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

Wanted—An educated and experienced draftsman. Davies & Thomas, Catasauqua, Lehigh Co., Pa.

Draftsman, constructor, 27. Experience in marine engineering, mach. guns, factory erecting. Mr. Berggren, 66 Willow St., Brooklyn, N. Y.

A young man of practical shop and drafting-room experience desires engagement as draftsman. Address F. W. R., 216 Summer av., Newark, N. J.

A draftsman with a technical education and some good experience wants position with some responsibility. Address Designer, American Machinist.

Graduate tech. college wishes position as draftsman or assist. supt.; specialty, high-speed engines; first-class ref. West preferred. Box 69, Am. Mach.

Wanted—A first-class machinist with $2,000; must be competent to take charge of shop; a good salary will be paid to a competent man. Box 70, American Machinist.

Secretary wanted by a large, profitable Mfg. Co. in Northern Ohio. A competent man with capital: first-class references required. Address Manufacturing, Box 437, Findlay, Ohio.

Superintendent of mfg. company in Mass. wishes to make a change; large and varied experience, with approved executive ability. Address "Randolph," American Machinist.

Wanted—After April 1st, position by strictly first-class mechanic as tool maker, where special machinery needs developing and constructing. Good wages required. Address Box 71, Am. Machinist.

Wanted—A first-class machinist for fine planer work; good pay and a steady job for a man faithful to the interests of his employer and capable of doing satisfactory work. Address No. 1 A B, American Machinist.

A competent tool maker and machinist wants a position to take charge of tool-room, or good place as tool maker; capable of designing machinery tools and special fixtures; first-class references. Address C. P. B., American Machinist.

Mechanical Draftsman—Wanted, at once, a first-class man capable of designing rope hauling plant, ventilating fans and air compress'g mach'y for mining purposes. Address, with testimonials and salary required, Compressor, P. O. Box "H.," Cleveland, O.

Wanted—An experienced and highly skilled mechanical engineer; one qualified to construct fine mach.; only a first-class man need apply. Liberal salary and permanency assured to right man. Give refs. and full particulars as to line of work in which heretofore engaged. The Lanston Type Machine Co., Room 104, Atlantic Bldg., Washington, D. C.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 25 cents per line, each insertion.

Crescent solid lubricant, clean, durable, cheap; prevents hot boxes. Crescent Mfg. Co., Cleveland.

The Crescent automatic grease cup is adapted to every service. Crescent Mfg. Co., Cleveland, Ohio.

Machinists.—Increase your income without capital or risk. See page 14, column 1.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State St., N. Y., consulting engineer for hydr. and pumping machinery, etc.

For Sale—Second-hand 72" mill for boring only; good order. A Garvin tapping machine, new. A. L. Henderer, Wilmington, Del.

For Sale—2nd-hand engine 16x36 in., 12 foot band wheel & Judson governor, all in good repair, $300. Geo. Strecker & Co., Marietta, Ohio.

For Sale—Patent and tools for making an improved combination square bevel protractor, etc. H. W. Merrill, 135 Oliver st., Boston, Mass.

Roper's Engineer's Handy-book, the best book ever published for Engineers. Post free, $3.50. Send for list. Thos. Ordish, 1723 S. 7th st., Phila., Pa.

Do you want anything designed, any invention perfected, or are there any stumbling-blocks that you want removed? A. H. D., Care Am. Machinist.

Wanted—Parties selling to steam users and supply houses to handle some good selling specialties on commission. Manufacturer, American Machinist.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

For Sale—A foundry and machine shop for the manufacture of anthracite mining and general machinery. Doing a good business. Good reasons for selling. For terms, apply to Wm. A. Cather & Bro., Shenandoah, Pa.

FLOW OF WATER IN RIVERS AND OTHER CHANNELS.

By Ganguillet and Kutter. Translated, revised, and extended by Rudolph Hering and J. C. Trautwine, Jr. 8vo, cloth, $4.00.

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Publishers of Scientific and Industrial Works.

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Combines the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the world.

BRADLEY'S HEATING FORGES.

With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements. For hard coal or coke. Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

Pat. Aug. 30, 1887.

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98 Sudbury St., Boston, Mass.
63 Murray St., New York.

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38 & 40 Hawley St., Boston, Mass. 36 John St., New York.

No. 0. GRINDING MACHINE, FOR LIGHT WORK, TOOL GRINDING, ETC. TAKES EMERY OR CORUNDUM WHEEL TO 12 IN. IN DIAMETER. ¾" ARBOR, AND PEDESTAL ON WHICH TO MOUNT ANY OF OUR SMALLER GRINDING MACHINES IN ABSENCE OF BENCH ORDINARILY USED.

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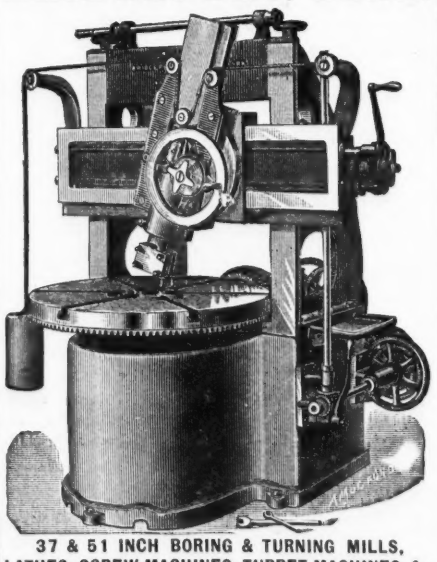
Bridgeport Machine Tool Works,

E. P. BULLARD, Prop.

BRIDGEPORT, CONN.



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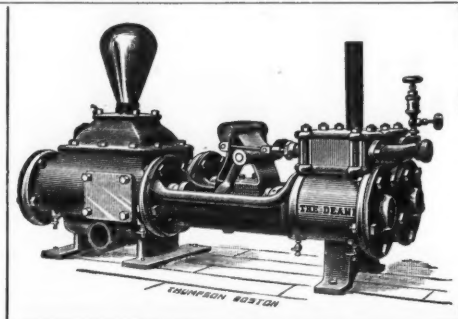

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16 inch x 16 inch x 4 feet.

For Die Work and use in Tool Rooms this planer is particularly adapted. It will plane accurately to a line, and stroke can be quickly changed from one inch to full capacity of table (4 feet), maintaining at the same time a uniform cutting speed. It has a cone pulley for change of speed, and automatic horizontal, vertical and angular feed. For above work it has proved a superior tool.

For Planers, Shapers or Engine Lathes, address

THE HENDEY MACHINE CO., TORRINGTON, CONN.

MUCH TIME AND LABOR NOW LOST

At the grindstone or tool fire can be saved by using our "CRESCENT EXTRA" Steel for Machine Shop Tools and Dies doing hard work. Always specify it in your orders.

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CRESCENT STEEL WORKS.

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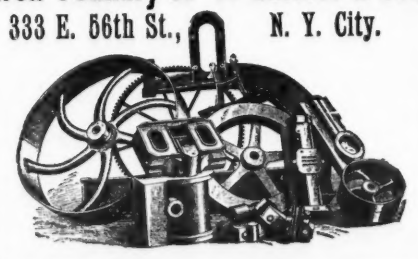

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"Star" Foot Lathe Swings 9x25 in.

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Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

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DROP FORGINGS OF IRON OR STEEL BEECHER & PECK, NEW HAVEN CONN.

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ACME, for high speeds and heavy work.

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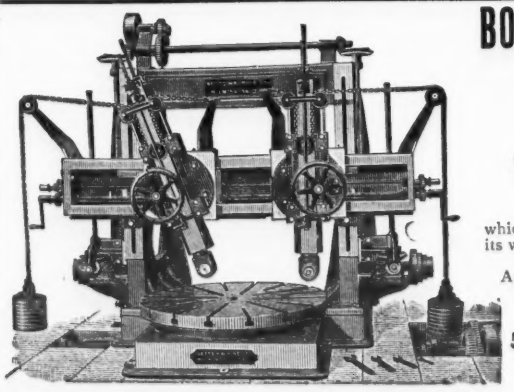

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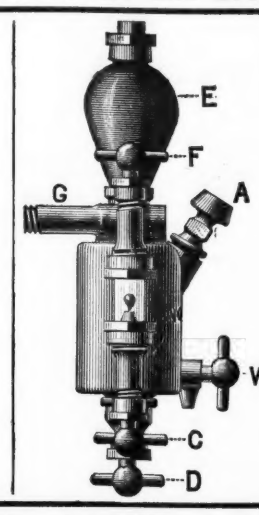

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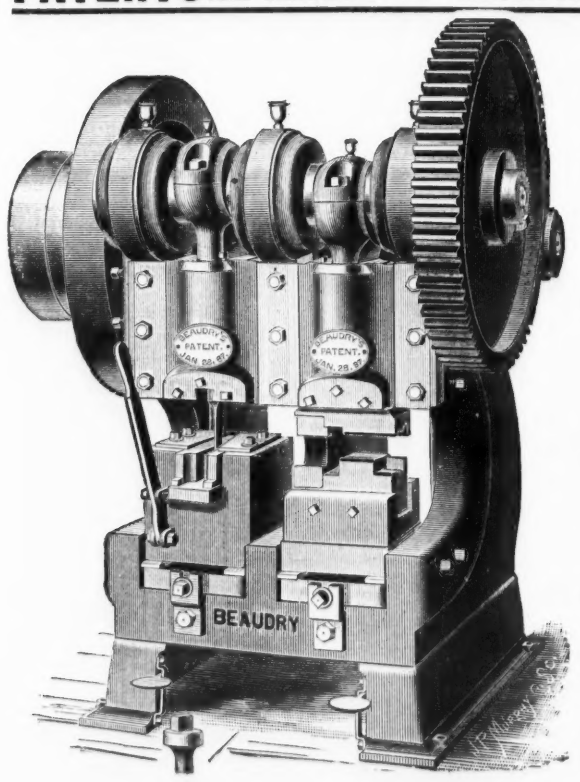

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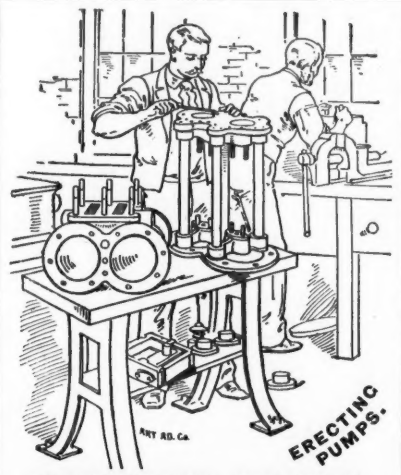

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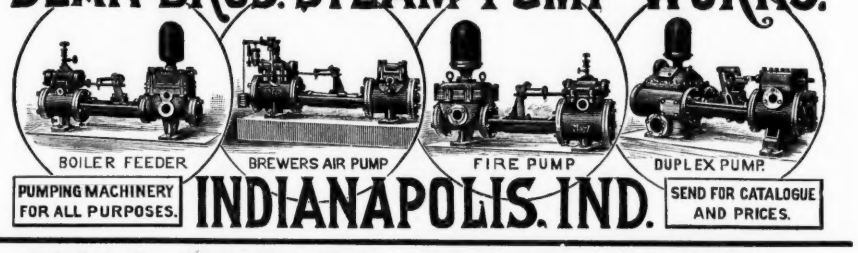

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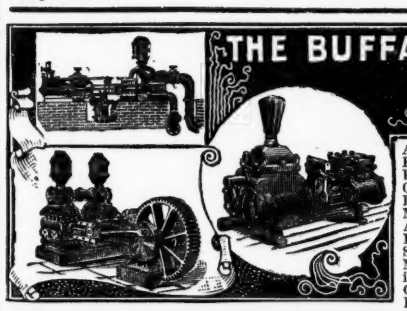

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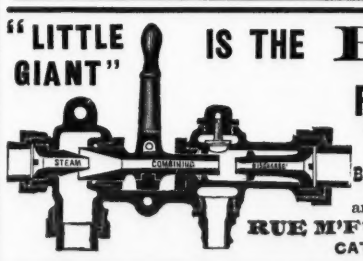

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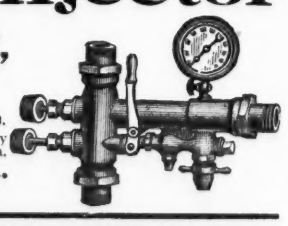

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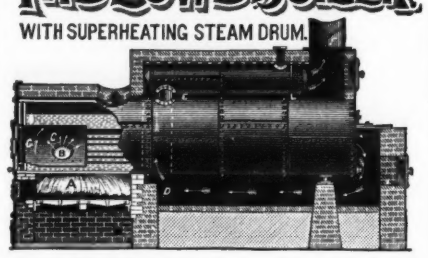

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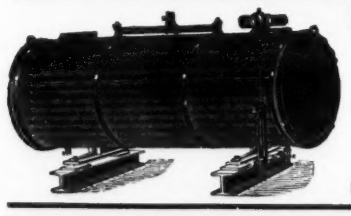

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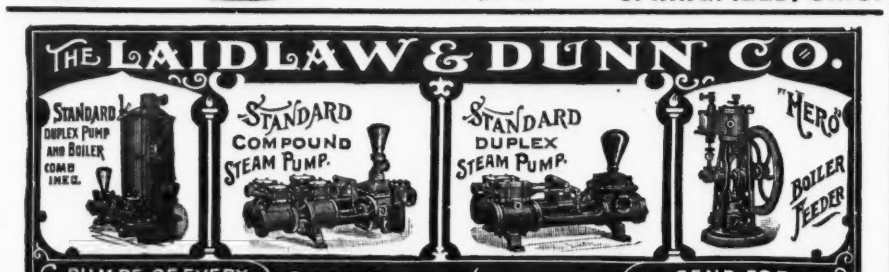

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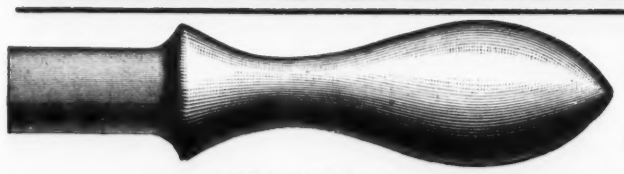

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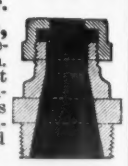

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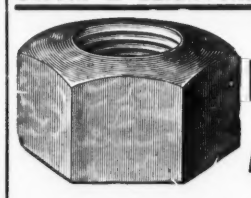

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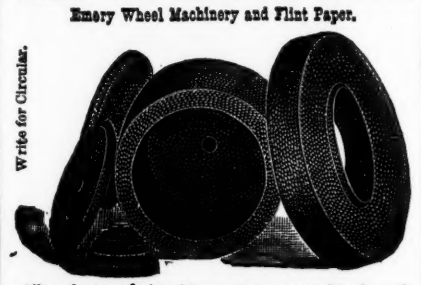

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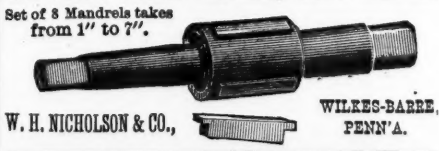

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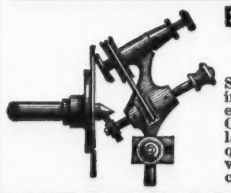

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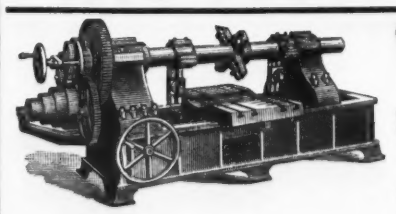

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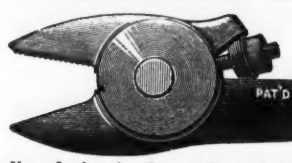

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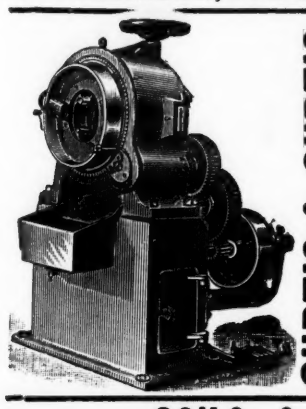

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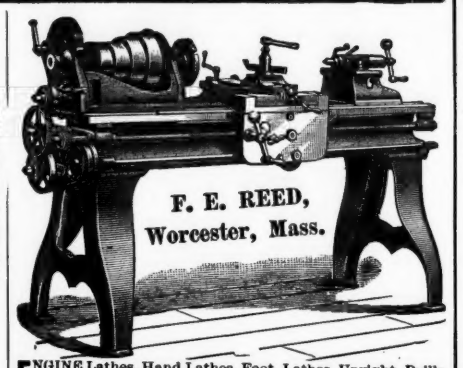

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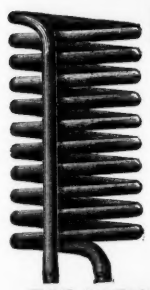

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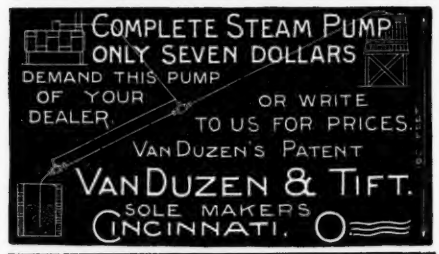

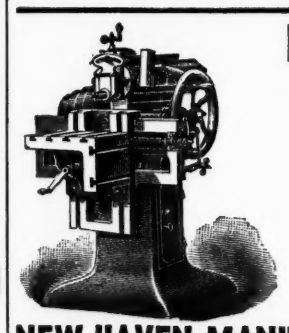

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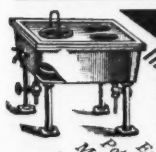

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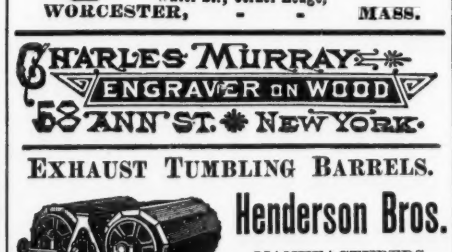

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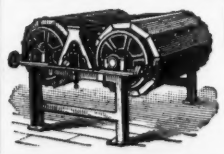

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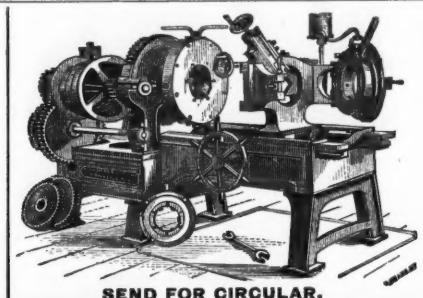

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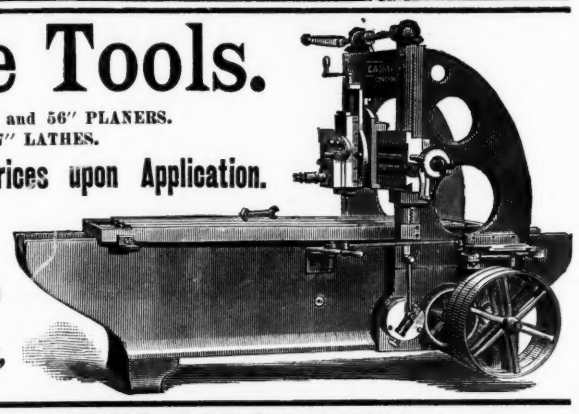

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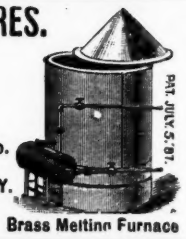

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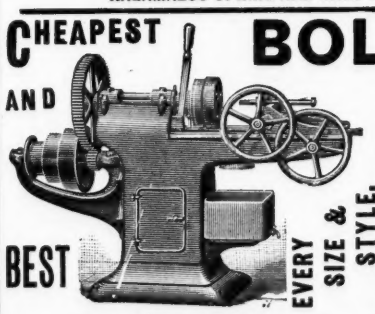

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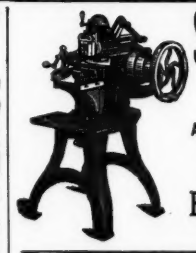

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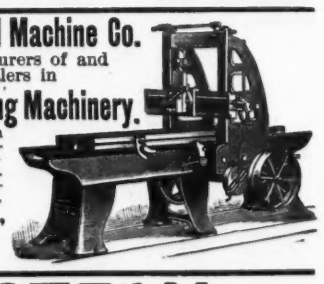

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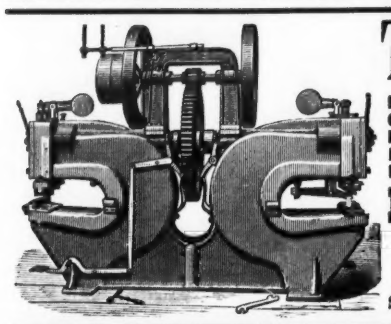

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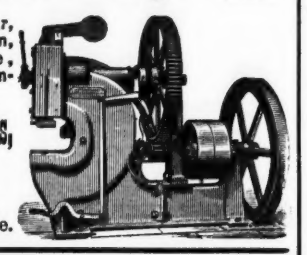

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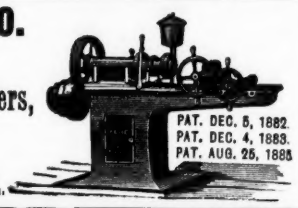

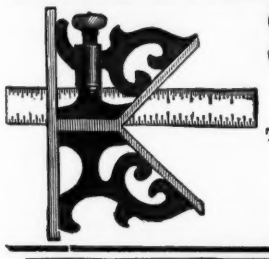

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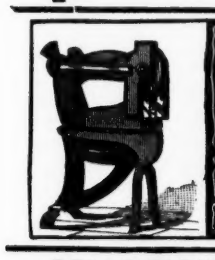

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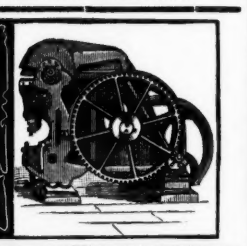

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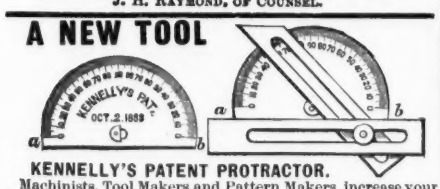

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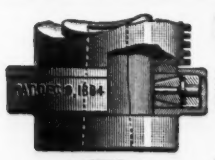

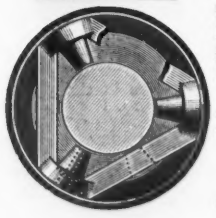

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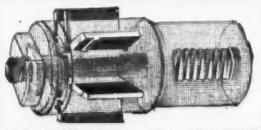

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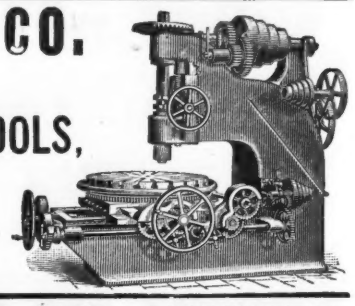

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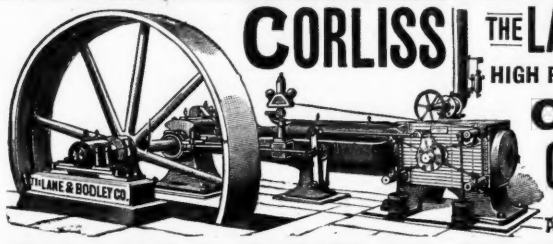

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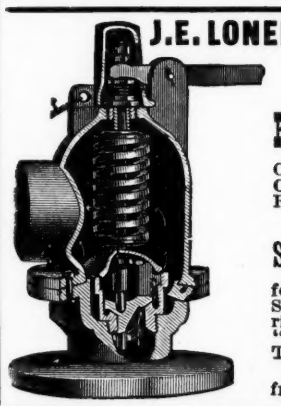

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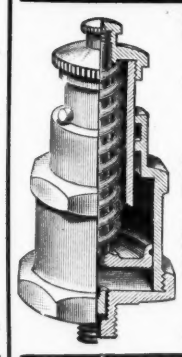

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A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

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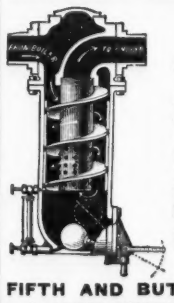

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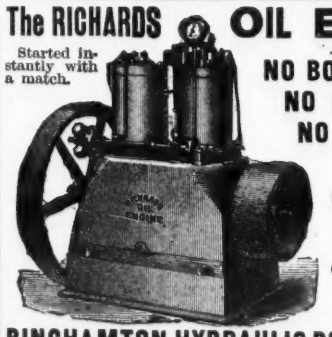

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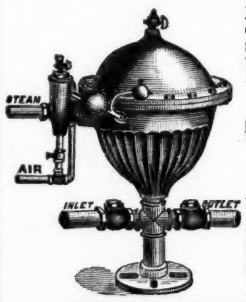

For returning steam, condensed under pressure, automatically into the boiler, under high or low pressure.

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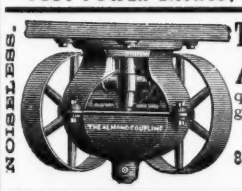

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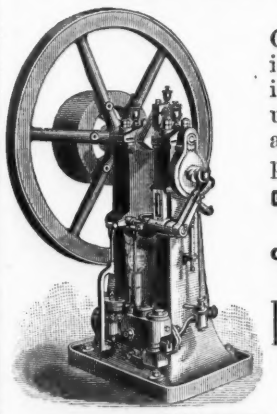

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OVER 125 IN USE IN N. Y. CITY.

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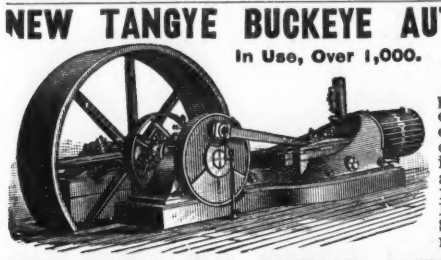

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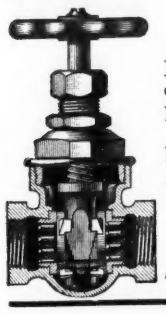

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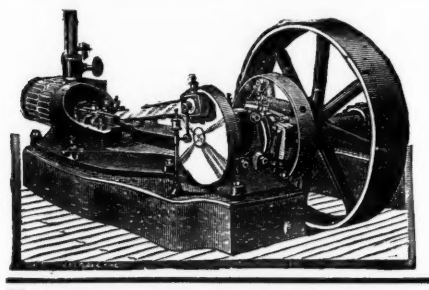

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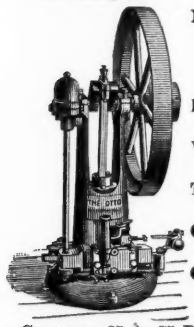

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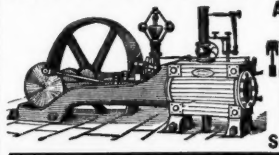

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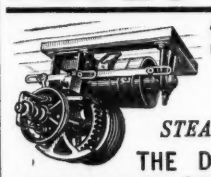

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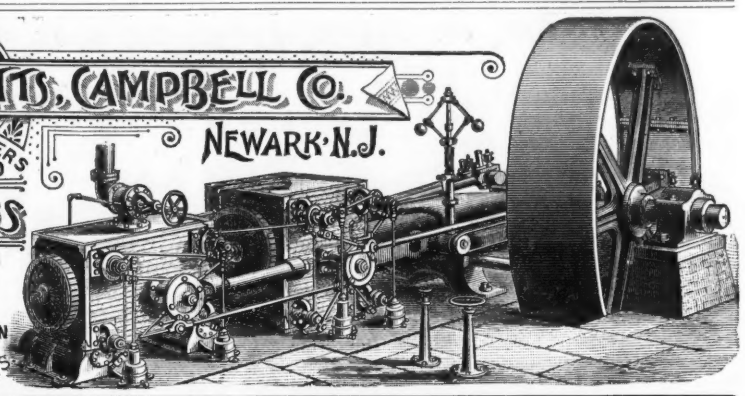

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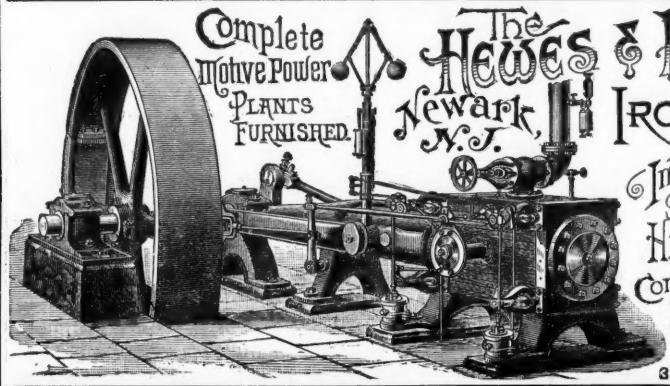

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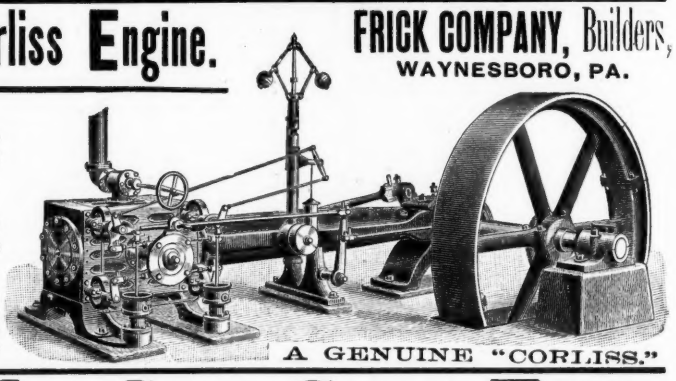

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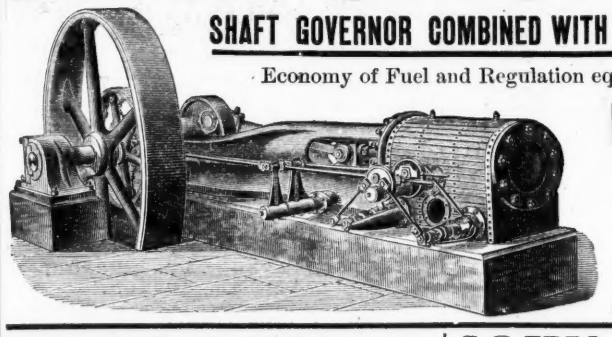

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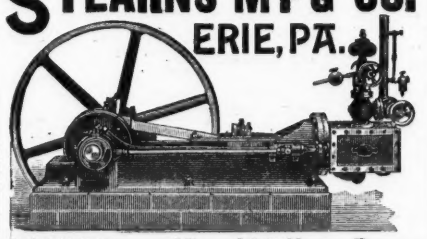

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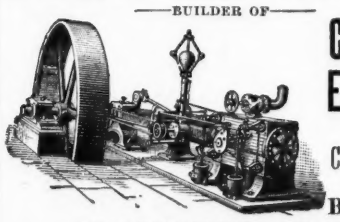

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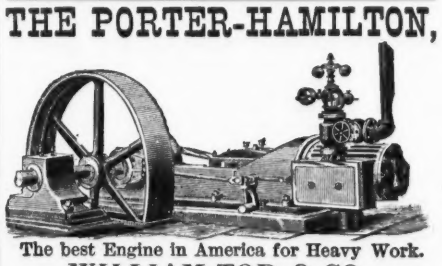

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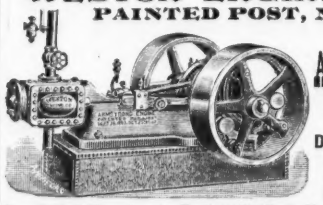

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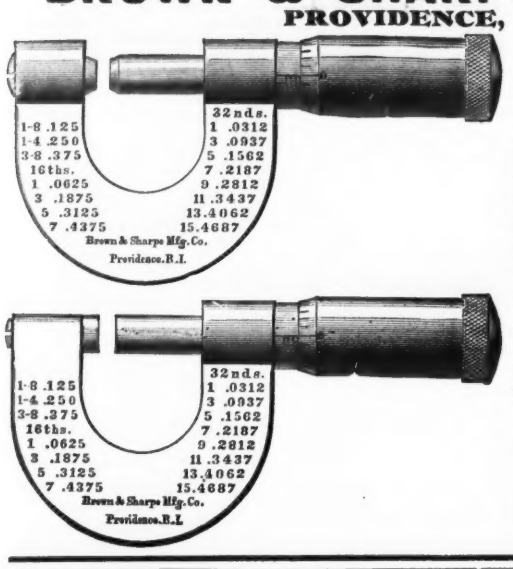

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These Calipers are, for many purposes, more convenient than Vernier Calipers, and are recommended to all persons desiring pocket instruments for quick and accurate measurements.

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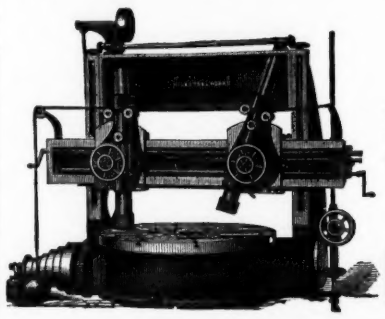
5, 6, 7, 8, 10, 12, 14 and 16 FT. SWING.



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Every Valve tested and warranted. All parts interchangeable.
Nothing but Best Steam Metal used in the manufacture.
Packed Stuffing Box and Disc Removing Lock Nut
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None are genuine unless stamped with "Trade Mark."
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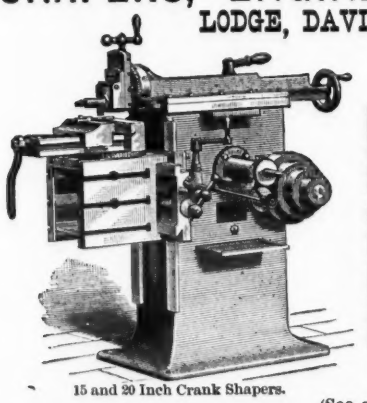

15 and 20 Inch Crank Shapers.

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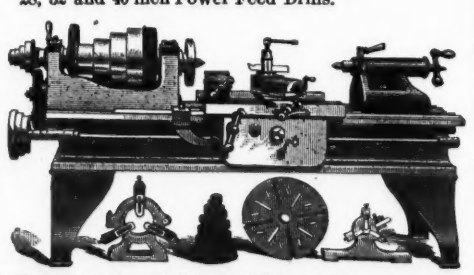
20 inch Upright Drills. 25 inch Back Geared, and
24 " " " 28, 32 and 40 inch Power Feed Drills.



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We consider it a **model tool** and fills the whole bill.

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King Iron Bridge Works, Cleveland, O.	9 "
Filler & Stowell Mfg. Co., Milwaukee, Wis.	2 "
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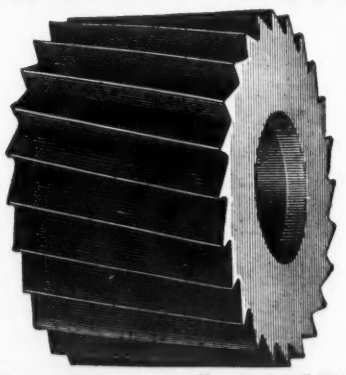

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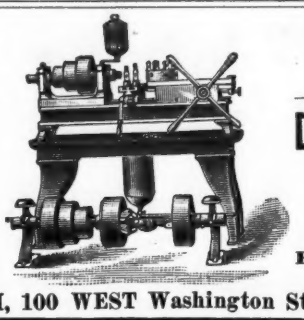

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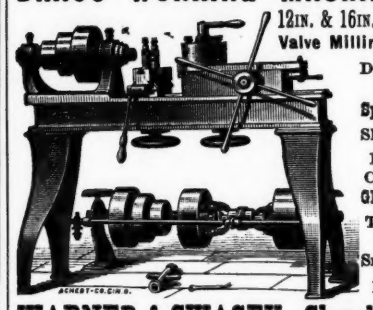

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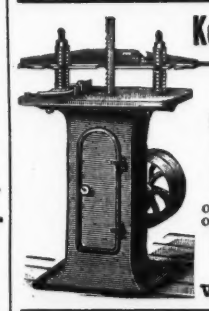

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